

Annual Report

of the SECRETARY OF
THE INTERIOR



Fiscal Year Ended June 30, 1946

UNITED STATES
DEPARTMENT OF THE
INTERIOR

J. A. KRUG
Secretary

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON, 1946
*For sale by Superintendent of Documents, United States Government Printing Office
Washington 25, D. C. Price \$1.00*

CONTENTS

	Page
Natural Resource Problems	1
Bureau of Reclamation	57
Division of Power	121
Bonneville Power Administration	125
Southwestern Power Administration	149
Bureau of Mines	155
Geological Survey	191
Solid Fuels Administration for War	221
Oil and Gas Division	231
Office of Land Utilization	235
General Land Office	245
Grazing Service	263
Fish and Wildlife Service	275
National Park Service	307
Office of Indian Affairs	351
War Relocation Authority	385
Office of the Solicitor	393
Division of Territories and Island Possessions	407
Puerto Rico Reconstruction Administration	426
Surplus Property Office	429
Board on Geographical Names	431
Division of Personnel Supervision and Manage- ment	434
Departmental Safety Program	438
Interior Department Museum	439
Index	443



THE SECRETARY OF THE INTERIOR
WASHINGTON

MY DEAR MR. PRESIDENT: I transmit herewith the annual report of the Department of the Interior for the fiscal year which ended June 30, 1946.

This report highlights some of the problems of natural resource management and development which face the United States. Some of these problems require immediate action; others must be met in the next few years; still others are of long-range significance both to the national economy and to the national security. All of them are responsibilities of the Department of the Interior upon which we have thought and worked during the past fiscal year.

Sincerely yours,

Secretary of the Interior.

The PRESIDENT,
The White House.

PART I

NATURAL RESOURCE PROBLEMS

OUR PROBLEMS AND PROGRAMS

The past year has been one of transition from war use to peacetime conservation. Our needs have gone from war materials to peaceful requirements. We have been short in many fields. The over capacity of plant that we had before the war saw us through several critical parts of that war. Where we were underdeveloped the Government had to invest billions in a hurry. Now we are moving to a very high level of national income. We are going to need more plant for many types of production. We are going to need more national plant for our resource development. In many western areas progress is being definitely held up at present through lack of reclamation land and water, and through power shortages. The expanding future is blocked by shortages in national plant as well as other lacks.

There have been a few national emergencies in the basic resource field, which covers land, forests, fish, water, parks, minerals, heat and energy. Coal strikes crippled production but did not waste our heat and energy resources, although they raised their price, and gave some urgency to alternative supplies which may in many years include atomic energy. The marginal metal mines presented a conservation problem which has been temporarily taken care of by the stockpiling act which provides for a continuation of wartime aid to them. The stripper oil wells presented a very similar problem of potential permanent loss of a valuable resource. The problem has similarly been covered by the Congress.

We do foresee several dangers to the national resource interest. First, our past neglect to take positive action to put our privately owned forests on a sustained yield basis, plus the enormous wartime demand, threatens an invasion and over-cutting of all our national forests, including that part which is under the Department of the Interior. We feel that would be compounding the past mistakes. We propose to fight against over-cutting on the public domain, for sustained yield operation of private forests and for more national and more private forests.

A second danger lies in the threat to neglect and thereafter to parcel out the rest of the public domain to private interests. We see that threat as an end to opportunity for the many, which has been the basis of our public domain policy and our homestead policy. Much of our public domain and many of our watersheds cross State lines. Great erosion control and reseeding jobs need to be done on them if the people are to keep on getting the meat they want to eat. A strong and

continuing policy is needed to prevent overgrazing and land destruction, and it must be an interstate policy. It must be a policy that is large and broad enough to consider the Nation's future rather than the funds available in any State treasury at any time. It must be a policy that recognizes the essential thriftlessness of spending billions on dams while we let the watersheds above them be ruined.

A third danger lies in the threats that the benefits of public investment in resource plant will be grabbed by a few people, and that the door of opportunity will be slammed in the faces of the many who now stand in front of it, waiting. It has been legislative policy for many years to get the electric power benefits from our great dams to the people. It has not been the policy of the Congress to button them up and turn them over to a few power companies at the dams. Yet some private utilities have fought, with some success, against the national legislative policy. We look upon these moves as repealers of the basic principle that public investment should produce the maximum of benefit for the greatest number of people. We see them as hampering the mineral and industrial development of the new regions by preventing industries from getting their energy at the lowest possible cost.

Another part of this same threat is the attempt to close the gates of opportunity resulting from public investment in the face of the veterans seeking land. The reclamation laws since the days of Theodore Roosevelt have held that water should go to build small family sized farms. That usually means that only 160 acres under one ownership can be furnished water. That is enough irrigated land to furnish a solid base for farming success and prosperity. In community property States such as California it means 320 acres where a man and his wife each own 160 acres. Yet large land companies and their adherents are trying to tear down that law for their own benefit and to the disadvantage of literally tens of thousands of veterans, farmers' sons, who are asking for an opportunity to buy land that has adequate water.

This is a problem of no small import to the Nation. We have found that small land ownerships create communities we can be proud of, and large land ownerships, which often make more money per acre, create settlements that are no solid foundation for health, local prosperity, education, or citizenship. If we are to junk 44 years of major national resource policy, we believe it should be done openly and after full public discussion.

The problems connected with utilizing Government resources and public investment to provide opportunity for free but also competitive enterprise does not stop at the basic resource level. During the war the Department early saw the need for more aluminum production, encouraged new enterprises to enter the field and helped persuade the

war agencies to invest in new aluminum reduction plants, and also in processing plants that could utilize the lower grade American bauxite. It believed that fuller utilization of this resource was necessary, and that competition would extend the use. Both convictions have proved to be correct. The Nation's aluminum plant is now many times that of the prewar period. The aluminum that went into bombers is now going into housing (taking some of the pressure off our over-cut forests) and many other uses. A large part of the energy produced at the Bonneville and Coulee Dams is being frozen in this form.

But the problem of retaining the competitive companies in the industry moves from the hands of the Government where it lay during the plant disposal period into the hands of private raw material companies. Because of this economic control of the basic resources we may see a few raw material companies putting a large new industry out of business, a result that would affect both the forest and power resources. Such a situation merits thorough investigation by the Congress.

Another major problem is that of coordinated development of our river basins. The difficulties and programs of each river basin are different from those of other basins. They must be met separately. For the Columbia River Basin where there are production and marketing agencies that could be competitive, where a pooling of all revenues is necessary for really full development of the region, the Secretary has come to the conclusion that when the people of the basin are eventually ready to support it, some form of river basin administration that will coordinate, but not supersede all the other agencies, is essential. The problems of the Missouri are quite different, and he has as yet made no recommendation for their most efficient handling. The Colorado is still in the stage of dispute and discussion about water rights, and it is hoped that the States both within the upper basin and the lower basin will come to an agreement on the most efficient use of the water.

All of these problems and dangers are matters of vital concern to all our citizens, for we all live on our natural resource base. They do not carry the impact of rapid change that the cotton South is facing. There the combination of tractors, mechanical cotton-pickers, flame-cultivators, other farm mechanization, and the change of the pattern to larger farms threatens to force two million farm workers into other occupations within 20 years. It might be possible for the Bureau of Reclamation to aid that situation somewhat by applying its long experience with drainage and irrigation to the swamplands of the South, and help bring in some useful additional acreage that would cushion the shock a little, and repay its costs to the Government.

We have grouped our problems and the programs to meet them under a few heads, which now follow. The yearly housekeeping reports of the agencies make up the part II of this annual report.

The Metal Mystery

Our industrial greatness was begun with the use of coal and iron ore in the East. It continued by sliding coal downhill and ferrying iron ore down the Great Lakes and manganese across the oceans to meet it. Alloying metals for steel came from the West, and copper from the West helped put electric power into almost every factory. Our industries chewed up vast quantities of lead and zinc from Missouri, Oklahoma, and Kansas. But the metal economy was not yet complete. During the Second World War aluminum went from 14,000 tons monthly to 94,000 tons to put our planes into the air. Magnesium went from 300 tons to 21,000 tons a month.

The war drain on metals was huge, comparable to the drain on petroleum. It has become a mystery to most students of the problem how we can go on being the greatest metal-using nation of the world when our reserves of copper, lead, and zinc are all seriously over-depleted and rising in cost, and when our best iron ore, in the Mesabi Range, is subject to exhaustion within another 20 years. There is even some thought that the barter process of the prewar decade that made gold our most valuable metal import, while the manufactured goods we exported drained our other mineral resources, should be arrested, and a new exchange sought. The suggestion has been made that our exported goods be paid for in raw materials, including minerals.

The mineral agencies of the Government (Geological Survey and Bureau of Mines) have worked out a series of approaches to the basic problem of assuring some continued national basis for our mineral and metal economy. The first of these steps is an inventory job on a national scale. It involves intensive work in discovery and examination of whatever mineral resources we may still have. The new geophysical methods, where they are applicable to minerals, will also be used. The war-time use of the airborne magnetometer for finding U-boats underwater is being applied to finding significant mineral deposits under land.

Before the discovery portion of the program can get very far there has to be more basic mapping of the geology of the Nation. At present less than 10 percent of the country has been mapped on scales adequate for the exploratory guidance now needed. In this respect, the United States ranks with the less industrialized nations of the world. In addition to basic mapping, some further work has to be done on the background of badly needed minerals so that we will know where to start looking. It involves securing data on reserves which mining companies have not yet made available to the Government, partly for fear of taxation by the several States which tax declared reserves in the ground rather than production only. It will involve drill-testing of many ore bodies. Above all, it involves putting cost tags on our resources, and

making these cost tags take into account all the possible economies that can be obtained from newer mining and processing methods and from lower cost energy. At present many know that there are vast amounts of phosphate rock in the United States, but no Federal agency has ever attempted to draw a distinction in value to the Nation between rock that would cost \$2 a ton to mine and rock that would cost \$20 a ton. The present figures on American mineral reserves are therefore largely meaningless, even for a war economy when price is no object but the expenditure of effort and machinery still is.

This inventory job may cost a billion dollars, and would normally take 20 years to complete. It could be speeded up, however. At any rate, we would know what we have, and what it is worth. We would know also the degree of our actual dependence on foreign sources, the possibilities for a continued flourishing mining industry in this country, and possibly also the point at which substitutions of one mineral for another and of plastics for specific minerals can be expected to become important factors in our economy. The billion dollars would underwrite petroleum and coal as well as mineral inventories. The Geological Survey feels reasonably optimistic that the discovery of important new sources of both metallic and nonmetallic minerals will result from this work.

The depletion problem affects not only the mineral areas but also the metal working areas of the Lake States. Under Secretary Oscar Chapman has stated the Department's thought in this connection as follows:

"It is the hope of the Interior Department that new processes can be developed to bring into production low-grade domestic ores. We want to aid in doing that as much as possible, since otherwise large mining sections of this Nation will shut down, and the impact on the States and areas directly concerned will be disastrous locally, and will spread out over the rest of the Nation. We have no desire to hasten the increase of foreign minerals except in the form of stockpiles for security purposes. These would be critical and strategic minerals. At the same time we find it desirable to have sufficient foreign imports to allow our manufacturing industry to produce fully. We simply want the American mining industry to be kept operating on an economic basis as long as possible.

"The St. Lawrence Seaway and the power plant attached to it become important in this depletion picture in the following ways: Whenever, in the future, we are forced to go on an increased import basis, the whole metal fabricating industry of the lake area will unfortunately suffer a slow but profound shock. That shock will come from the preference that the coastal areas will acquire when foreign minerals are shipped to this country. They will arrive at the coast ports from abroad, instead of coming to the lake area from the Middle West or

Mountain area. The tendency will be for metal fabricating to move out of the lake area, particularly toward the east coast, to gain the advantage of the lowest costs.

"Such a movement would profoundly change the character of economic activity in the lake area. Such a movement would also put the mineral resources of the Middle West and the Mountain area farther away from their markets than they now are and force a lowering of their already very thin margin of profit to an impossible point. They simply cannot afford to absorb any more freight costs. The mineral areas of the Mountain and Middle West, therefore, stand to gain by any effort that will benefit the lake area. The St. Lawrence Seaway represents a stabilizing factor in the situation.

"The Department of the Interior has always favored a widespread mineral development of domestic resources. The mining industry is the basic industry in many of our Western States. I would be reluctant to see developments that would shut off that industry, but this seaway, with a maximum importation of 8,000,000 tons, of which only a small part will probably be used for minerals, will not result in any such shutdown. On the contrary, it will help the Western and Middle Western mining States to the exact extent that it helps keep the metal industry of the lake area just where it is now, close to the domestic sources of minerals."

The third part of the approach to a solution of the Nation's metal mystery is somewhat more audacious. It is that of adding values to our low-grade minerals by finding an entirely new use for them, much as the value to the Nation of uranium was increased immeasurably when its use shifted from an ingredient in the glass and pottery industries to a source of energy. It is pointed out that the possibility of lowering costs enough to warrant converting low-grade American manganese into the equivalent of metallurgical foreign manganese for use as ferromanganese in steel making is to all intents and purposes impossible. But its conversion into electrolytic manganese, a new metal, with certain desirable properties all its own, is quite possible. The finding of a new use pattern is the missing part of this approach, and may be the essential requirement for the expansion of some of our nonindustrialized regions.

The fourth approach has been taken by the Congress. It is that of authorizing continued subsidy payments to high-cost mineral producers and stock piling minerals for possible war needs. The Bureau of Mines provides statistical data and furnishes economic and technical advisers to assist the agencies directly charged with the administration of these programs.

The health and safety of mining personnel is also a major concern of the Bureau of Mines, although it has no authority to regulate mining

operations. Accidents in mining are more frequent than in any other industry except lumbering, and are more severe than in any other with no exception. First-aid training has helped some. The dust that accompanies extraction is a health hazard in the metal mines and both a health and safety hazard in the coal mines. In addition to further education, the Bureau favors the introduction of rock dust into coal mines to prevent or limit explosions. This should be supplemented by wetting in some workings. More and better methods of mechanical ventilation should be adopted. Blasting should be done after a shift has left the mine or only after thorough wetting or rock dusting of the immediate region. Fumes should be removed by ventilation before workmen enter the working place.

There should be rigorous and periodical health examinations of miners. The Bureau notes that the accident rate has been going down and believes that "there is no question that accidents in the mining industry could be reduced at least 50 percent (possibly as much as 75 percent) below what they now are, in which event the financial savings would amount to millions of dollars annually to both workers and operators." In 1945, 1,034 men were killed in mine accidents. A 50-percent reduction would leave 517 men alive each year. A 75-percent reduction would leave 775 men alive each year. It should be noted that, in another resource field, a flood which has drowned 40 to 60 persons and threatens to do it again every 10 years or so has been found to be ample justification for the investment of hundreds of millions of dollars of public money.

Heat and Energy

The amount of energy used by a Nation is a good index of its industrial position in the world. The per capita use is a good indication of its potential standard of living. The future of the coal and petroleum industries depends to a large extent on the rate at which we increase our national use. In 1915 we had a national production of 17,100 trillion British thermal units. By 1929 it was 25,400 trillion, and did not get above that until 1940, when it was 25,600 trillion. During the war it was shoved up to 32,300 trillion. In other words it took us about 25 years to add 8,500 trillion and then in 5 more years we added on another 6,700 trillion, almost four-fifths of the 25-year increase. The war-time addition alone in 1945, if it had all been put into the form of electric energy, would have produced 447 billion kilowatt-hours, the equivalent of a herd of 68 million horses working every minute of the day and night.

To produce this additional heat and energy for the war, the coal industry went up from a 1940 production of 512.7 million tons to 630.9 million. The petroleum industry went up from 1.4 billion barrels to 1.7 billion barrels. The marketed production of natural gas increased

from 2.6 trillion cubic feet to 3.7 trillion. Hydroelectric capacity was increased from 11,700,000 kilowatts to 14,900,000 kilowatts. Our energy increase (26.5 percent) between 1940 and 1945 was a little greater than our steel increase of 19 percent from 67 million tons to 79.7 million.

The very considerable war-time increases used up a large part of our best coking coal. They drew heavily upon our oil reserve and productive capacity. They used up a valuable part of our natural gas, although many new reserves were discovered. Meanwhile our current rate of petroleum discovery in new pools is only about one-half of our rate of use. We are living largely on past discoveries and the hope that there will be more, although we know that the rate of discovery has been going down. Our proved reserves are estimated at about 21 billion barrels, while in 1945 we used up 1.7 billion barrels, and peacetime expectations are for an even greater demand in the years ahead.

The mineral and conservation agencies of Interior see their first job in this field as that of helping to find more oil, gas, and coking coal, and to obtain better recovery from the resources that have been found. That is part of their discovery, inventory, and research program. The work of discovery has become more expensive and difficult. Geophysical instruments of various types have to be used over wide areas and with rigorous accuracy, and their evidence must be interpreted from a wide and imaginative geological background. The areas that seemed possibilities, certainly those with outcroppings or obvious favorable surface evidence of favorable structures, have already been examined and drilled. Among the great remaining hopes are two places, discovery of stratigraphic trap-oil pools far below the surface, and salt domes on the continental shelf under water adjacent to oil-bearing regions, in the Gulf of Mexico, Coast States, and existing fields in California. There is considerable optimistic opinion among geologists that we may hope to find about as much oil again in the future as we have in the past, in the range of 50 billion barrels, but it may cost much more to find and produce than it has cost up to now.

Exploration in the Western States is particularly important. As Secretary Krug has stated: "The war brought into sharp focus the strategic importance of oil supplies to operations in the Pacific area. It demonstrated the strategic significance of the fact that only one-fourth of the proved oil reserves of the United States are located in the Western States and that, elsewhere in the Western Hemisphere most of the oil supply is on the Atlantic, rather than on the Pacific side."

There are several other ways to increase our oil reserves in addition to discovering new deposits. One of these is secondary recovery of oil left in the ground after the original pressure has been exhausted. We

know that there are several billion barrels of oil remaining in our older fields which were not recovered during the primary steps of production. The study of methods to make that oil more readily recoverable is worthy of our best scientific effort. At present in addition to water-flooding, the induced pressure of gas or air is utilized, and heat has been tried. These are engineering operations of considerable magnitude, and the improved recovery may require several years to materialize. The mineral agencies of the Government believe that they can aid in working out such secondary recoveries on public and private lands, in a way to benefit the whole industry.

The third approach is through a synthetic fuels program which will bring down the costs of producing oil from coal, oil-shale and asphaltic sands, to a place where it would be reasonably competitive with natural petroleum.

Congress has authorized the Bureau of Mines to work in this field and to use several pilot plants. The five-year program will cost about \$30,000,000. The past experience of German plants is expected to be extremely helpful. At present large capital expenditures for work on synthetic fuels would be called for by individual companies, and while several private plants are being planned to produce synthetics from natural gas, the threat of a high rate of obsolescence for the early plants, due to advancing technology, may influence others to wait. In addition to the threat of rapid obsolescence, uncertainty about the future rate of oil discoveries and the stability of oil prices also act as deterrents to private investment in such experimental plants.

If decline in the supply of petroleum is not postponed by a very considerable improvement in our rate of discovery, and we have to go the synthetic route, a considerable geographical dislocation and relocation can be expected to take place, affecting employment, population movements and investments. If we had to get the equivalent of as much as one billion barrels of oil out of coal, at the rate of 1 ton of oil from every 4 tons of coal, a huge coal production of roughly 572 million tons would have to be added to our present annual production of about 550 million tons. That production would probably have to come from the areas where strip mining is possible, and costs are lowest.

The best present estimates of the Bureau of Mines of the cost of oil production are as follows, even assuming \$1 per ton for strip-mined coal; and \$0.50 per ton for oil shale:

From coal: \$3-\$4 per barrel (unrefined).

From oil shale: \$2-\$2.50 per barrel (unrefined).

In 1946 the Congress decided that the discovery of petroleum on public lands would be increased by revision of the mineral leasing law to set a fixed royalty on oil produced in place of the sliding scale previously existing.

The equivalent of replenishment of our own reserves may be secured in part by importations of oil. From the conservation viewpoint the extent to which we can produce oil without causing physical waste is a prime factor in measuring our needs for oil from outside sources. Late in the war period we were forced to overproduce our fields by about 300,000 barrels daily in order to meet military and essential civilian needs. For a short period we lost the benefits of well-organized production that we had gained through conservation in the late 1930's, when it had become clear that the overproduction in the industry was destroying the resource base as well as ruining the participants in the industry. Foreign supplies must be geared to the situation of the domestic oil industry as well as to the needs of the rest of the Nation's industries and homes. The need for such foreign supplies is obviously of a different order of magnitude today when we are using substantially all of our efficient productive capacity from what it was in the pre-war days when we had a reserve capacity of a million barrels daily that we could bring into production at any time. In this connection it is necessary for us to have reliable, disinterested yearly estimates of our efficient productive capacity.

Another part of the program of the industry and the States and Federal Government should be that of attempting to salvage and get into useful service more of the wasted gas that comes up with the oil. In 1943, about 684 billion cubic feet of natural gas were flared or otherwise wasted or lost. This is one-fifth of the total used. Translated into electric energy this is almost 50 billion kilowatt-hours, or over four times the 1945 production of the whole TVA system. Our wasted gas alone represents a lost energy about equivalent to the utility power used in the United Kingdom at present. The problem of collecting that gas (in addition to, and in competition with the natural gas already entering pipe lines) from widely scattered oil fields is one that we have never tried to meet. It would take from four or five Big Inch plus Little Big Inch pipe lines to carry it when and if it were to be collected. Or if, instead of being transported, it could be collected at a cost of 5 cents per thousand cubic feet and processed at or near the fields, it could produce over 68 million barrels of gasoline at a total cost of about 5 cents a gallon. The economic difficulty in the way of any conservation approach is that no incentive exists to produce either the gasoline that would come from the wasted natural gas, or to use the scattered gas from the oil fields, as long as natural gas from gas fields with an assured supply, and high pressure, can be had for a lower price.

This particular resource waste might stagger any nation less rich in resources. It equals in heat value about 113 million barrels of oil. It would equal three-quarters of the stripper-well production which qualified for subsidies under the stripper-well premium plan of OPA

and of the Defense Supplies Corporation. This amounted to \$56,000,000 in 1945, and three-quarters of it would represent \$42,000,000.

A final part of the program lies in the advance in the technology of use so that more service is obtained from each barrel than at present. Secretary Krug has said: "There should be no holding back in this type of development. Once science has shown the way, the benefits of research in the better utilization of petroleum should be made available. Oil is too valuable to the Nation, too hard to find, and there is not enough of it to permit wasteful practices in its production, handling, and use." The Bureau of Mines is at present working on greater utilization of the marginal, lower-quality oils, and upon the adaptability of oils from the various producing areas to the manufacture of specific needed products. It is also working on the possibility of blending fuel from coal and oil shale with natural petroleum.

The oil industry does not expect to be competitive with the coal industry except in the fields of transportation and in residential and office heating, in which it also encounters the competition of the gas industry. Its preferable output is gasoline, Diesel oil and lubricants, rather than residual fuel oil. It is counting on adjusting its processes to meet the demand for jet propulsion which now utilizes kerosene, but may call forth a somewhat different product. Petroleum products are beginning to supply the base for a large chemical industry.

There is some expectation that in the course of time the domestic price will be increased and will allow far more discovery work, will keep the marginal producers in operation and will also get the synthetic production under way for coal and oil shale. One of the major interests of the industry is whether the synthetic production, which involves securing coal and oil shale as raw materials at very low costs, will be undertaken first by the coal-mining industry, the petroleum industry, or the chemical industry.

The natural gas industry is attempting to expand its outlets into Northern industrial cities. It is competitive in the heating field with oil and coal. Its bid for the Big Inch and Little Big Inch pipe lines has not been acted upon in a permanent fashion up to date of writing. It hopes to transport 400 million cubic feet daily through them, which is the equivalent in heat content of about 7,500,000 tons of coal annually. The continued expansion of natural gas northward has met with opposition from some producers of manufactured gas, some railroads, some coal operators and the miners. In some of the producing States also there is considerable discussion as to whether to encourage the export of this valuable and diminishing resource for use in other industrial areas, or to attempt to secure the advantages of the production of gasoline and chemicals from it near its origin. The Federal Power Commission has

been charged by the Congress with examining the national significance of the problems involved.

The President has established within the Department of the Interior an Oil and Gas Division to coordinate Federal duties and policies in these industries.

The greatest part of our national heat and energy still comes from coal. In 1945 it supplied about 49 percent of it. In that year 576 million tons of bituminous coal and 55 million tons of anthracite were produced. The prewar production, in 1940, was respectively 461 million tons and 51 million tons. Byproduct coke went from 54 million tons to 72 million to help make our war-time steel supply.

The supply (disregarding costs of mining) is still vast. Anthracite reserves are still 15,730 million tons, of which 60 percent might be mined at a price. Gross bituminous reserves are estimated at 2,221,000 million tons. Lignite reserves are 939,500 million tons. No figures are available to show the estimated reserves that can be mined in the neighborhood of the approximate 1945 cost of \$3.03 for deep bituminous coal or \$6.21 for anthracite, or in the neighborhood of \$2.30 for strip-mining. The one great shortage is in good coking coal.

The Bureau of Mines expects that coal production will continue to increase slowly in a general way with the new high level of economic activity and the normal population growth. Between 1950 and 1960 it estimates a bituminous production of between 530 and 580 million tons, not including any call on the industry for coal to produce petroleum products.

The Bureau of Mines has a well-worked out program on coal, which it has been carrying out for many years. This program includes: (1) Improved mining practices, to reduce costs and loss of life and health; (2) improved coal preparation techniques, to reduce ash content and to make raw coal more valuable to the producer, and to save money in haulage of nonusable products. A reduction of 1 percent in ash content at the mines would save the freight bill on 6 million tons; (3) improved coal storage, to eliminate fires and make coal safer and cheaper for consumers; (4) studies of marginal coals to make possible their substitution for higher grade coals; (5) studies of coal combustion, including coal in powdered form to allow for more efficient and more economical use; (6) conversion of various types of coal and oil shale into petroleum products at the lowest possible cost; (7) studies of anti-corrosion methods and feed-watering conditions to protect boilers using coal with corrosive elements; (8) studies of uses of the fine size of anthracite coal as a substitute for a portion of the low-volatile bituminous coal used in coke-oven charges; and (9) studies of the carbonizing properties of new coals for the benefit of coke-oven operators.

In addition, the Bureau of Mines believes that: (1) Further research is needed in the development of methods of treatment of high-sulfur

coals that will either remove the sulfur or convert it into such form in the coke that it will not appear in the pig iron; (2) further research is also needed on the complete gasification of sub-bituminous coals and lignite; and (3) the possibility of using gas produced directly from coal still in the ground by a Russian process justifies some research. The product might be used for the production of energy or for synthesis of liquid fuels and other organic materials.

The bituminous coal industry had a large over-capacity during the depression years of the 1930's, which forced prices down and produced losses in large sections of it. For several years plans for minimum price control were developed, and such controls became effective in 1940. They were administered by the Bituminous Coal Division of the Department. They lasted through 1941 and then war requirements made maximum rather than minimum price control a national policy. Distribution of scarce coal became essential, and this was administered by the Solid Fuels Administration of this Department. The post-war situation has been very favorable to the industry to date, and no strong demand for minimum prices is expected unless a severe depression is encountered. The new high level of industrial activity in the Nation has narrowed the gap between capacity and requirements considerably, and there is no large overburden of idle capacity hanging over the price situation.

The mineral agencies of the Department are aware that competition between oil and coal can be expected in the near future. However, they believe that since it would be uneconomic for the petroleum industry to produce fuel oils as such, but only as byproducts of gasoline and then only at a minimum rate, the relative amount of such competition may decrease, and may be of less importance in the industrial fields in the future. In certain markets it may occasionally be a disruptive influence for the coal industry, but not on a national scale. Natural gas, however, may affect coal markets considerably until the processes have been developed which make its conversion into gasoline more profitable, or until it appears to be approaching exhaustion. In case coal is also called on to supply some of the petroleum requirements, losses to natural gas will be made up very rapidly, although possibly by other parts of the coal industry than those suffering the direct impact of natural gas.

Hydroelectric Power

In 1920 the Nation had a hydroelectric power production of 15.95 billion kilowatt-hours, in 1940 it was 47.74 billion, and in 1945 it had reached 79.97 billion. It went down from 36.8 percent of the total national utility production in 1920 to 32.9 percent in 1940, and went up to 36 percent in 1945.

The Department of the Interior and the Tennessee Valley Authority are the major Federal public power producers and marketing agencies.

The latter increased its system power, which includes steam plants, by 7.9 billion kilowatt-hours between fiscal years 1940 and 1945. Interior increased its system energy, which is all hydro, from 3,306 million to 17,819 million kilowatt-hours in the same period. This includes energy produced at Boulder Dam, which is not marketed by the Department, and energy at Army dams which is not produced by the Department but is marketed by it.

The Interior power agencies are located largely in the Western States. The Bureau of Reclamation has power plants in many of these States, from which it markets energy. The Bonneville Power Administration, which markets the energy produced by the Columbia River system, from dams built by Army Engineers and the Bureau of Reclamation, operates in Washington, Oregon, Idaho, and Montana. The Southwestern Power Administration, with headquarters in Tulsa, Okla., will market energy from the Arkansas-White-Red River systems in parts of Arkansas, Oklahoma, Texas, and parts of Louisiana, Missouri, and Kansas. In addition, Congress has directed the Secretary of the Interior to market the power from dams built by the Corps of Engineers. The major dams that have been authorized for construction by the Army Engineers lie in the area stretching in a crescent from Kentucky and Virginia down through the Carolinas, Georgia, and Alabama. It will also market energy from the huge Davis Dam power plant now being constructed by the Bureau of Reclamation on the Colorado River and from the Mountain Home, Hungry Horse, and other authorized projects of the Bureau.

A rough estimate of the possible growth in the hydro system under the management of Interior can be made for the next 15 years, on the basis of only present authorizations by the Congress.

[Millions of kilowatt-hours]

	Fiscal year		
	1940	1946	1960
Bureau of Reclamation (excluding the Columbia).	3,052	7,886	18,446
Bonneville Power Administration (including the Columbia).....	208	6,236	29,828
Southwestern Power Administration.....	0	736	2,567
Southeastern Army projects.....	0	0	4,319
Total.....	3,260	14,858	55,160

If the fuel used in place of this hydropower were oil, the saving would have ranged from 8.6 million barrels in 1940 to 39.1 million in 1946, and will be in the neighborhood of 145.2 million barrels in 1960, estimating 380 kilowatt-hours per barrel.

The Government's investment in the power portions of the dams, and in the transmission lines and substations was approximately 428.5 million dollars in 1946.

The waterpower resources of the Nation were among the few that were not depleted by the war; instead their utilization was increased. They helped to win it and they remain after the war as major assets of the regions and the Nation. A slight postwar decline in power use was expected, but it now appears that this will be temporary. In 1946, partly due to the return to Shasta Dam of the generators which had been installed in Coulee during the war, the Pacific Northwest was so short of power that every oil-burning reserve plant was operating, and only a small fraction of the normal reserves was available in case of trouble. The continued demand for aluminum for peacetime uses, including housing, is largely responsible for this shortage. When electric appliances are again available it is expected that the demand will increase far above the prewar rate.

The great power programs of the Federal Government are expected to add within 20 years, 3.7 million kilowatts of capacity to the Colorado River area, 7.5 million to the Columbia, 1.8 million to the Missouri, 1.4 million to the Arkansas-White-Red area, 1.7 million to California and 4.7 million to the Southeast, a total of about 20.8 million kilowatts. This addition represents twice as much hydroelectric capacity as the whole Nation had in 1936.

There are five major problems which have to be considered with a program of this size, and of this potential significance to the Nation.

The first deals with the basic usefulness of low-cost public power in stimulating the regions where the power is located to new industrial growth. As it happens, almost all of Interior's programs are in areas which need and want a considerable amount of new industry. That includes the Pacific Northwest, the Missouri, the Southwest, and the Southeast. To create new industrial developments, particularly in the areas where agriculture and industry are out of balance and population and markets are still small, requires a very low rate for energy. Not all of the rivers are miracles like the Columbia which has a tremendous volume of water all the year round and maintains a heavy run-off in the summer months. Many of them are flashy and irregular, producing little firm energy. To secure their full benefits for the region and to prevent waste of resources in the streams the Department has found it necessary to plan to have steam plants tied in with the hydroplants. This is true of the Arkansas-White-Red River systems, and of the Sacramento River in California—where most of the river has been dedicated to the use of navigation, salinity repulsion and irrigation, and some of the Shasta Reservoir to flood control storage space—with the result that but little firm water is available to improve the quality and value of the hydro-energy. Similarly, the rivers of the Southeast must be supplemented by

steam plants to produce large quantities of firm power. While the Congress has appropriated funds for a considerable number of such firming steam plants in the Tennessee Valley, none has been built as yet for the Interior systems.

The second problem, of increasing the value of the energy to the region through steam plants, is intimately connected with the first problem, of getting low-cost power out of the rivers. The first problem has increased in difficulty because of the rise in price levels. Dams may now cost from 50 to 80 percent more to construct than they did in 1940. If such dams were to be constructed as emergency public works projects, in times of depression and of low prices, as Bonneville, Coulee, and most of the Tennessee Valley dams were constructed, there would be no cost problem. However, most of them have flood control and navigation functions which cannot be postponed indefinitely. In addition they have power functions, and the growing power demands of the regions call for more sources of power, promptly. If these additional necessary power plants are built by the utilities because of postponement of hydro projects, the utilities will suffer when the lower-cost hydroplants are finally built, or rather, if they are built before the steam plant capacity has been absorbed. If on the other hand, the hydroplants are built regardless of cost, because of the need, the benefits of lower cost power for the region are likely to evaporate, in case there is an overall lowering of the price level. In some cases low-cost upstream storage may improve the situation.

The third problem is that of efficient timing, construction and management of multiple-purpose projects. It is the job of squeezing every drop of moisture and every ounce of energy out of the rivers. The concept of use for all purposes is a basic one in our conservation policy. Untamed rivers have been a savage destructive force. They have caused large damages to property. They have taken many lives. They have washed away precious topsoil. Every year 600 million tons of topsoil still find their way into the Gulf of Mexico. In the West flood waters rush past dry land that needs only water to make it prosperous. Development of a river as a unit means that instead of considering only flood control, or navigation or irrigation or power, an attempt is made to get the greatest amount of all of them that is possible by combination. In addition, fish life has to be protected by regular run-offs in the spawning season and by fishladders around dams. In some rivers enough water has to be provided to push down the incoming tides and save land from being permeated by salt water. In most rivers, water for municipal and mining and industrial uses has to be made available. There are also pollution problems, and recreation facilities to be considered. State interests in the water have to be protected.

A series of studies are now being made of major river basins looking towards their proper development in order that each may yield the ultimate benefits of which it is capable. Reaching the correct answer to the various problems presented is difficult and complex because of the number of Federal agencies and State bodies involved. The planning for flood control and navigation is under the Corps of Engineers. The planning for irrigation and part of the power is under the Bureau of Reclamation. The study of the power markets and the authority to recommend power installations in War Department dams is under the Federal Power Commission.

The Department of the Interior which has the responsibility of marketing the power is not in a position to control the many factors which are involved in its cost. In order that the most efficient over-all job be done in connection with the sale of power from these multiple-purpose projects it is extremely essential that the Department of the Interior, as the marketing agent, should participate actively in (*a*) the original preliminary studies, (*b*) the choice of the most desirable projects, (*c*) the determination of the size and character of the electrical facilities, (*d*) the timing of their submission to the Congress for approval, (*e*) the allocation of their costs, (*f*) their accounting and repayment, and in addition, (*g*) should share responsibility for the timing of the installation of power units, (*h*) the characteristics of the electrical facilities, and (*i*) be responsible for the operation of the projects for power purposes.

A recognition of some of these difficulties has brought about a working agreement and the formation of what is known as the Federal Inter-Agency River Basin Committee, consisting of representatives of the Army Engineers, the Department of Agriculture, the Federal Power Commission, and the Department of the Interior. This has formed the basis for a better coordination of the programs of the affected agencies and closer integration of policies. It is a very large field and the work is by no means complete. Much remains to be done before the maximum benefits from fully developed river basins can be realized.

On the Columbia a magnificent combination was made some years ago where Coulee Dam adjoins a million acres of dry land. Huge quantities of water, about 4 million acre feet, will be pumped up to serve that land, and will flow through costly reservoirs, canals, and ditches. The original nonunit river development plan was for a low dam for irrigation purposes only. The irrigators would have had to pay the cost of the dam and of all the irrigation works themselves, or about \$630 per acre. The plan actually adopted was for a high dam which will have a capacity of over 2 million kilowatts of power, and will pay \$222 per acre for the irrigators, who will themselves only have to pay an average of \$85 per acre. At the same time the high dam backs up such a large

lake of water (9.5 million acre-feet) that it will firm up energy for all the future dams that will be built in the course of time on the river below Coulee. These, in turn, as they come into being, will be in a position to pay for the storage value to them of the Coulee Reservoir.

Columbia energy may be responsible for another type of direct conservation effort. At present the total energy utilized for all purposes in the Pacific Northwest is split 12 percent hydroelectric energy, 33 percent oil, 21 percent coal, 34 percent wood. The increase in hydro-production saves oil. Yet wood is one of the most valuable resources of the area. It has been increasing in price. Through the development of wood waste for chemicals, instead of using it to produce steam in the pulp mills, industries are being added to the area. The Bonneville Power Administration, which markets the power of the Columbia River system, consequently plans to conserve this raw material by sending energy to the pulp mills (except in low-water years) at a rate in the neighborhood of 1½ mills per kilowatt-hour. In addition to that, it expects in time to offer a relatively low rate for home heating which should also save wood waste. That home-heating rate in turn will be made possible by, and will make possible, a low-summer rate for sprinkler irrigation which will be of major advantage to vegetable and fruit growers in the area.

A fourth major problem is the relation of new Federal power developments to private utilities operating in the area. They usually take the position that they should be the sole or major distributors of the energy, and propose to take their lines right up to the Federal dams. This would tend to restrict the sale of Federal power to these distributors. On every occasion that the problem has been presented to the Congress in legislative form it has decided that preference in use (not in rates) should go to public bodies such as municipalities and cooperatives, and since these could not economically construct high tension lines to the dam, the public marketing agency should be authorized to build such lines to the market, and also to interconnect various hydroprojects with its own lines in order to get the fullest value out of the combination. In 1944 in the Flood Control Act of that year, the Congress designated Interior as the marketing agency for all energy at reservoir projects constructed by the Army Engineers, and wrote into this act the preference for public bodies. The Department of the Interior has taken the position that the various acts of Congress affecting public power lay upon it an obligation to get low-cost energy to the whole region, with preferences to public bodies. It sees equality of access to the power, as represented by public high-tension lines, as a necessary part of this obligation. The Department is interested in wholesale and very large individual industrial use, and not in general distribution. It sees no departmental conflict with the private utilities in the distribution field.

The public power dams and lines are paid off in 50 to 60 years with interest ranging from 2.5 to 3 percent. The power portions of the structures are then entirely debt free, and in good operating condition.

A fifth problem of importance lies in the relationship which power consumers have to water users. For the most part, the power brought in on western rivers has been of such a distinct advantage to the power users that they could make a contribution in the form of aid to water users and still have a very considerable power benefit. The notable example is at Coulee Dam where the power users will pay an extra one-twenty-fifth of a cent per kilowatt-hour and thereby make possible the development of a million acres of land and a number of communities that would not otherwise have been possible. However, there are few dams as large and economical as Coulee, and the rising price level will make it harder for consumers of higher cost power to contribute as heavily (\$228,000,000) as Coulee contributes to irrigation. A complicating factor in the situation is that while construction costs are being incurred at high price levels, there is no certainty about agricultural prices, and consequently about the ability of the water users to repay a certain portion of the capital costs, and yet the water users have to accept their portion of the obligation before the projects are undertaken.

A forward step in the Flood Control Act of 1944 makes it possible for low-cost units of the Missouri Basin project to help carry the high-cost units in a pooling operation. This gives every irrigating farmer who lives in the arid part of the basin an equal opportunity to gain advantage from the power drops in the river, regardless of the fact that he may happen to live many hundreds of miles away from the steepest, and most valuable power heads. Similar pooling arrangements for the Colorado and Columbia Basins should be made.

The much discussed relationship of hydroelectric energy to other energy sources, does not yet rise to the heights of a major problem. In the West where most of the undeveloped water resources are located, the oil saving which they make is obviously desirable from a conservation viewpoint. They rarely affect coal. In the Arkansas-Oklahoma area they are on the edge of the low-cost natural gas region. The dams in that area are mainly flood control and navigation structures and probably would be built even if no power could have been produced as a by-product and paying partner. The shortage in capacity means that hydropower might take a part of the future market from natural gas rather than the present market. A future hydroproduction of 4,808 million kilowatt-hours would require steam capacity consuming 80,590 million cubic feet of gas. However, since gas has a very low employment rate, the result is not of major importance to the stability of the economic structure. In the Missouri Basin most of the hydroenergy will have to

find new markets for itself. Some small part of it might replace old coal- or oil-burning power plants. It is too early to estimate accurately, but if this amounted to a fifth of the total, or about 1.2 billion kilowatt-hours, it would represent the equivalent of 780,000 tons of coal annually. If the whole 6 billion kilowatt-hours on the Missouri were considered as impinging on the future coal market, the effect would be to eliminate 3,900,000 tons of coal. That is still much less than 1 percent of the national coal production.

In the Southeast the proposed Army dams will not produce exceptionally low cost power. Costs will range around 5 to 6 mills. If as much as 4 billion kilowatt-hours are produced, and if all of it is to be considered as affecting future coal markets, a total of 2,600,000 tons of coal would be displaced. A considerable part of hydro prospects in the Southeast are economically sound only for capacity power. The only other major hydro possibility in the whole East is the St. Lawrence. This would produce about 13.2 billion kilowatt-hours for use in both the United States and Canada. It would be very low-cost energy. If the whole production of the project were assumed, to cut into future coal markets which would not be the case, it would displace only 8,580,000 tons.

While the whole potential hydro competition for future coal markets, at its most extreme, could be estimated in the neighborhood of 15,500,000 tons, this still represents less than 3 percent of the expected coal production, moreover it should be emphasized that this estimate represents only a few years growth of expected coal production, that it would be only enough coal to produce a small quantity of oil, in case the coal industry is to be drawn on for oil production, and, finally, that increased use of hydroenergy has normally brought with it an increased use of coal for firming hydropower and for the added commercial and domestic use that accompanies industrial growth. It might also be pointed out that in the 15 to 20 years during which these hydropower installations will be made, the steam electric utility industry, through its improved efficiency of use on any rate comparable with the past rate of 3 percent annually, will itself cut into future coal market expectations by over 30 million tons annually, or about twice as much as all the hydrodevelopments could effect under most extreme estimates.

Land Under Water

Another 20 years may see an additional 20 million people among us, and these new people will need millions of new acres of cropland to feed them. More land as well as better land, or more food imports, are going to be national "musts."

Putting water on the rich soil of arid Western States is one of the best ways to bring needed land into national use. It puts a solid crop base

underneath the cattle, mineral, and lumber economy of the Western States. It has the additional advantage of bringing in land in the West which is growing in population, and which has generally imported a large part of its food needs. At present there are about 21 million acres under irrigation. The Bureau of Reclamation furnishes water to about 5 million of the total, the Office of Indian Affairs administers about 850,000. The Bureau has another 5 million acres in prospect, the Indians another 750,000 acres. Early irrigators found that water poured on the dry lands of the west brought forth rich crops. Thus many pioneer irrigation systems were built hurriedly without the hydrologic studies that are a commonplace in irrigation development today so that in dry years the demand for water far outran the supply. Nearly 10 million acres, principally on non-Federal systems, are farmed with insufficient irrigation water. The Bureau plans a major resource rescue operation to bring supplementary water to these lands.

Possibly Congress will allow as much as 5 billion dollars to be invested through the Bureau of Reclamation in the course of the next 15 years. Of this total, projects which will cost 2.5 billion dollars to complete have already been authorized. Some of the investment will be in dams which perform flood control, navigation, and siltation functions or which produce power. The reclamation and power features are paid back into the Treasury over a 50- to 60-year period. A portion of the power revenues are usually set aside to help the irrigators pay off their obligations. On the great Columbia Basin project in eastern Washington, where 1,000,000 acres will come into production in what is now a sagebrush desert, power from Coulee Dam will contribute 228 million dollars to the repayment of the capital costs, and the irrigators 87.5 million dollars.

The capacity of the Bureau's hydroplants was increased during the war from 1,160,000 to 2,250,000 kilowatts. They saved 36.5 million barrels of fuel oil in 1945 alone when 14 billion kilowatts were generated in those plants. The Coulee and Boulder plants produced enormous amounts of energy that went directly into weapons of war.

Like other agricultural areas, the reclamation lands suffered somewhat during the war from upset of crop balance, reduction of maintenance, shortages of fertilizer, omission of cover crops and heavier production of soil depleting crops. Many of the areas were stopped in their development by war demands that took the steel and labor they needed for expansion or protection. Those hundreds of thousands of acres are still suffering from deficient water, or from seepage, alkali deposition or salt intrusion, and will continue to depreciate in value until canals are built and water is delivered.

In spite of war-time troubles the settlers in Bureau projects produced during the war 13.6 million bushels of beans, 124.5 million of grains, 16.6 million of seeds, 373.4 million bushels of vegetables, and also 7.9

million tons of sugar beets, 12.6 million tons of alfalfa, 2.2 million tons of forage crops, 2.5 million tons of fruits and nuts as well as 670.5 million bales of cotton. The alfalfa and forage crops alone were enough to produce 150 pounds of meat per man for an army of 4 million men for 4 years.

The process of bringing great new resources into being is not without its problems. One of the major difficulties in securing all the possible benefits from a river basin is that two, three, or even four Federal agencies have been given jobs by the Congress that affect seriously any over-all basin development. Water put on thirsty land, and power to help pay for the land development and yet be sold at rates low enough to stimulate high industrial and residential use, seem most important to the Department of the Interior. The Fish and Wildlife Service wants a minimum of damage done to fish and fowl, and compensatory investment where the damage is unavoidable. The Indians do not want their base lands flooded out by reservoirs without receiving equally good lands elsewhere. Navigation and flood control are the major interests of the Army Engineers, but they also have plans to build purely power structures. The Soil Conservation Service is interested in preventing erosion and consequent siltation in the reservoirs. The Federal Power Commission advises the Army Engineers on power structures and reviews rates on energy production at their dams. In the Columbia Basin there is a separate power marketing agency, the Bonneville Power Administration; in the Colorado Basin, the city of Los Angeles and the Arizona Power Authority are interested in marketing large portions of the output.

In programs of such magnitude conflicts must inevitably occur. Major differences between Federal Agencies, between States, between local groups, have developed as expected in all of the major river basins. Certain of these differences such as those on the Colorado River involve the rights of sovereign States and can only be resolved by inter-state treaties. A compact commission headed by former Commissioner of Reclamation Harry Bashore is at work preparing an inter-State allocation of the waters of the upper basin. Conflict over construction of Foster Creek Dam on the Columbia was resolved by the Congress. Fishing interests have sought postponement of Umatilla, a major navigation and power dam, and of five minor navigation dams on the Lower Snake, pending consideration of the possibility of reorienting salmon runs into the lower tributaries of the coastwise rivers. Studies of pollution, location of other prospective dams on those streams, and completion of biological investigations, are involved in making this choice. Repayment of irrigation costs in the semihumid Missouri Basin is a major problem. In the Central Valley of California the basic tenet of Reclamation law that water shall only be furnished to family-sized farms is being vigorously questioned by proponents of the large farm pattern.

These conflicts are not irreconcilable. Machinery for their solution by democratic processes providing for the participation of various Federal agencies and States in the formulation and development of comprehensive basin plans has been set up under the Flood Control Act of 1944. Coordination of State and Federal planning is secured through the operations of the Federal Inter-Agency River Basin Committee comprising the Departments of the Interior, Agriculture, and War, the Federal Power Commission, and the Governors of the States affected in each case. Within the Department of the Interior there exists the Missouri Basin Field Committee and the Water Resources Committee to adjust and evaluate the interests of the agencies involved. The Columbia Basin Inter-Agency Committee is working at solution of the manifold problems involved in that great valley development.

This technique is an adventure in cooperation. All the conflicting voices are heard. All the points of view of every affected interest are reflected in the reports that go to the Congress. Where the differences are so great that they cannot successfully be compromised, the final decision is rendered by the elected representatives of the people. It has been operating now for a little more than 2 years, not long enough to demonstrate its full potentialities in river basin development.

Another major problem is that of providing the benefits to each area which can come from relatively low power charges. Congressional legislative policy has been in favor of public transmission lines to carry energy from dams to municipalities, electrical cooperatives and other public agencies, instead of blocking up the energy at the dams. However, in the individual cases of the Arkansas Valley and the Central Valley of California funds for these lines have been difficult to secure. Interconnections with adjoining basins may be possible in time, now that long distance transmission is becoming more feasible. The problem of stimulating regions industrially through low-cost power is particularly urgent on rivers such as the Arkansas, Red and White, where the flow is irregular and flashy, and considerable reservoir storage has to be left empty for flood control, and on the Sacramento where prior commitments have been made to let down water for navigation, salinity control, irrigation, and fish protection, and little remains in reserve for power alone. In these areas the Department believes that steam plants are necessary to firm up the hydro energy in order to secure the major advantages of the river to the people of the region.

Part of this problem lies in the fact that our basic irrigation pattern is changing. We are planning to pump uphill for irrigation use a large part of the Columbia, the Sacramento, the Missouri and possibly the Colorado. Power now appears in its true role as the working partner of irrigation. Great blocks of energy are put to work on the Reclamation project pumping water, which could otherwise produce large commercial revenues.

A problem that still lies undiscussed in the background of Federal loans for great multiple purpose reclamation projects is the extent to which such an investment should be used to produce in part certain crops which are in peacetime subsidized in one form or another.

Over the next few decades the water put on land in the West and guided through turbines ought to put a new face on all of our great western river basins, the Arkansas, the Colorado, the Columbia, the Missouri, and many lesser streams. It will make our farms more liveable and more profitable. It will hold people in States that have been losing population. It will feed all of us better. The job of building great dams itself stirs the imagination of man. The job of getting the most out of the rivers for the people should do so, too.

One of the main objectives of the Bureau of Reclamation is close-knit interdevelopment of town and country, of small business, small industry, and farms. This establishes an area in which the greatest possible number of people may enjoy a good livelihood. This is the primary aim of the acreage restriction of reclamation law, which is occasionally attacked. Stated in simplest terms, this law limits to 160 acres or less the amount of land held in one ownership that can be supplied with irrigation water from a Bureau of Reclamation project. Acreage restriction is basic to conservation of land resources. By preventing consolidation of individual farms into huge holdings with attendant evils of tenancy, sharecropping, and monopolistic control, it furthers stable settlement, conservative treatment of the soil, and maximum utilization of land resources. Rural and urban areas in the vicinity of reclamation projects receive mutual support. The townspeople provide a ready market for farm products. The independent farm owner-operators have greater purchasing power and require local enterprises to supply them more than an equivalent community of tenants or hired hands.

Extension of predevelopment work to all projects opening new land to cultivation is strongly urged. Successful settlement of irrigated land requires production of salable crops the first year. This is necessary to enable the settler to pay his living expenses, establish a home, and meet construction and operation and maintenance charges as they become due. Hasty, inadequate, and improper preparation of the land for irrigation, however, results in irreparable damage to the individual farm and to the project as a whole. The proper development of raw public land for irrigation frequently calls for heavy equipment that the farmer cannot afford to buy. The Bureau of Reclamation has been authorized to undertake reimbursable predevelopment of some public land homesteads. This includes rough clearing and leveling, roughing-in of farm distribution systems, and protection against water and wind erosion. Work that the settler can satisfactorily perform with ordinary

farm equipment is not included in this program. Orderly, planned development of the land resources and conservation of the limited water supply is facilitated by initial preparation.

The great programs of the Bureau of Reclamation include bringing 5,360,000 acres into cultivation or stability in the Columbia River Basin. Of this 3,840,000 acres are new land and 1,520,000 acres are land which will receive supplemental water. The plans for the Missouri look to the transformation, by irrigation, of more than 5,000,000 acres of range and dry lands into steady wealth-producing irrigated lands which will stabilize the living for 400,000 families. In the Colorado River Basin, after the States settle their uncertainties concerning water rights, the Bureau of Reclamation stands ready to aid in bringing in 1,533,960 acres of new land and of putting supplemental water on an additional 1,122,270 acres. In the Central Valley of California, the Bureau's program will furnish water to 550,000 acres of new land and to 1,550,000 acres of land requiring supplemental water.

Home on the Range

Much of our red meat eats off the Government. One beef animal in every five and two sheep in every five get about 4 months of their feeding each year in the public domain, and in spite of the low quality of most of the range, get it for very little. There are 145,000,000 acres of Federal range lands, and the beef animals pay an average of 20 cents and the sheep 4 cents a season. The Grazing Service of this Department (which was amalgamated in July 1946 with the General Land Office into the Bureau of Land Management, and cut heavily in staff) administered 60 grazing districts. In addition to the Federal land it covered 119 million acres of State and private lands. The total area was 264,000,000 acres. That is an area greater than Colorado, Wyoming, and Montana combined. It is largely in the arid part of the West.

Meat consumption has gone up during the war. With over 120 pounds for each person we took our place alongside the Australians and New Zealanders as the greatest meat eaters in history. There is going to be continued public demand to keep that rate. Every million people added to our population wants to eat the equivalent of 150,000 steers, and that means another 12,000,000 acres put into the range-alfalfa-corn-feed lot complex. Our population may go up by 20 million persons in the next 20 years before it levels off, and the necessary 240,000,000 additional acres for meat are not going to be easy to find. Already many of our western irrigation projects are becoming winter-feed growing centers for the surrounding dry-land range. Submarginal eastern and southern land can and will be put into pasture. However, the great bulk of the needed feed will have to come from improvement of the quality of the western range.

But the public range does not take care of itself. It can be, and has been overcrowded and overgrazed until it can no longer carry a normal load. The overgrazing led to erosion. During the past war years, the range came through in pretty good shape. It was not ploughed up in important parts as it was during the first World War. Not much was done to prevent continued erosion, but no new bases for ruin were laid. The Federal range may now be considered to be not more than 50 percent efficient for its purposes.

The range needs seeding with grasses adapted to each area and climate. Instead of 10 acres of sagebrush land feeding one cow one month we need planted forage where two acres of grass will do exactly the work of 10 acres of sagebrush. It needs more waterholes, trails and fences, although already fences have been put up long enough to cross the continent twice, and trails enough to cross it about four times. Some two million acres borrowed by the military services will have to be rehabilitated. All the improvement work plus increased security of range led to better terms on cattle loans, and contributed to the stability of the industry.

The basic pattern of public range use in the Western States is individual ownership of lands producing forage for winter use and open public domain range in the grazing districts and national forests for the remainder of the year although several million livestock, mostly sheep, use the semidesert Federal ranges in winter. There is complete interdependence, except in the Southwest, where much of the range is available all year round and became part of the individually owned base properties. The Taylor Grazing Act of 1934 recognized this interdependence, and gave preference in the public range to individuals or companies already owning base lands nearby. But there was more base property than range, so priorities of use were applied, limited by the amount of livestock which had been run on the range. Those with base properties but without priority came next. There has been relatively little land available for the second group. Newcomers into the livestock industry have to buy their way in through the acquisition of base properties.

The industry is not entirely in a few large hands. Over three-fourths of the number of grazing permits are in the hands of men with less than 200 animal units, which is about the economic bottom limit for a herd. They average 55 units. But the remaining 25 percent of the users graze three-quarters of the units and average 557 units. The basic legislation does not give preference of any type to the small ranch owner or cattle homesteader. There is no limit to the amount of range that can be leased to an individual or company which has sufficient base lands even if it acquires these base lands from others. The United States Forest Service has developed an administrative system on the grazing lands in the national forests which gives some preference to small ranch-

ers, but no great permanent increase in the number of small permit holders has resulted. This may well be due to the fact that 200 animal units constitute an economic bottom limit, and small holders cannot acquire the additional basic land and consequently the range permits for such a number.

The housekeeping job to be done on the range includes not only seeding and forage increase, water holes, fence and trails, but protection against range fires. These still burn vast areas. Usually the reseeding process should follow such fires. After fires the grass or seeds present usually grow with vigor, but there is seldom sufficient of either, or of the proper kind, to make up the loss. Rodent control and control of predatory animals are also part of the job.

One of the major public problems at present is the future of about 200 million acres of public domain. Much of this land can be a valuable national resource if it is well-administered, brought into condition, and kept that way. The costs of doing that are repaid annually in profits to livestock raisers. The fees collected for use of the land have been low.

The Department, with years of land-management experience, believes that there is a suitable use and a public interest in all forms of land. It is convinced that sound and forward-looking national policy demands that these lands be administered as a whole, that they be administered well, and that the Federal Government should have responsibility for what is basically an interstate task.

Land Without People

In addition to 145 million acres of lands in Federal grazing districts and 56 million acres of Indian land, this Department supervises about 83 million acres of forest, mineral bearing, and other unclassified land in the continental United States, and another 344 million acres in Alaska. In the main, this is the last remaining part of the "public domain," the land which nobody wanted very much, the land without people. This remnant on the continent is a tiny fraction of the old public domain of 1.4 billion acres. It has 20 million acres of forests, but does not include the 170 million acres of national forests which are under the supervision of the United States Forest Service in the Department of Agriculture. It does include about 14 million acres of national parks and 6 to 7 million acres of wildlife refuges and game ranges.

Much of this remnant of 83 million acres (the size of New Mexico) has never been surveyed in detail. Much of it has never been classified as to its possible use. The basic problem here is: What is the best use for it? Its optimum use for the Nation is not known. By and large the Government has given parts of it away whenever anybody wanted it, and has also given away the mineral rights to large portions

of it. During the war the military services found about 32 million acres in the United States and Alaska useful for their purposes.

The Department's program is first, to get the best of all this land classified so that areas appropriate for grazing can be used for grazing, either adding potential forest lands to present forests or to sustained yield units, any possible overlooked agricultural land can be segregated out for pioneering soil breakers, and any particularly good recreational opportunities can be more fully appraised. This land classification job might cost as much as \$7,000,000 in the United States. The same job, which has been started in Alaska, should be speeded up if veterans and other prospective settlers are to be spared the disappointment of seeking to establish homes on lands unsuited for this purpose.

The second part of the Department's program is to get the mineral bearing parts of this land (and of the much larger grazing area) segregated out, and a conservation policy worked out that will put the mineral resources to use as the Nation needs them.

Third, the forest woodlands are to be used to produce their fair share of the lumber and other wood needs of the Nation, but are not to be sacrificed through overcutting. These Interior lands with about 31 million acres of woodland and 16 million acres of Indian-owned lands produced about one billion board-feet in 1945. Sustained yield management is to be maintained or established. Cooperative agreements to cover adjacent or intermingled private forest lands are to be pushed in the interests of a stable and nonmigratory lumber and wood industry. Forest surveys and inventories are to be continued until all the forest land has been covered. Restudy of the "in lieu" tax payments to States is to be undertaken. Fire, disease, and insect protection is to be continued and expanded. The first parts of this program are revenue producing (\$3,400,000 in 1946) and far more than cover the cost of forestry management. The second part costs money (\$1,200,000 in 1946) which produces revenues in future years by preventing losses.

Fourth, this area, along with the wide grazing lands, is to be protected from further erosion where that is economically possible and desirable. In addition to check dams and other preventive methods, a great amount of reseedling has to be done. This can be speeded up, and also be done most economically by plane. We have gone back to the birds. Seed for trees and grasses is wrapped in pellets of fertilizer with a little poison to prevent its destruction by insects, and dropped where it is needed. The force of the drop gets the pellet on the surface, where it waits there until rain activates it. The cost of seeding by this method is about \$2 per acre, compared to \$4 for seeding with ordinary farm machinery. Some years will be needed to test the advantage of this pellet method on range lands.

This land, plus the grazing land, plus the Indian lands, totals 282 million acres which are under the Department of the Interior. They do not include lands in Alaska. More than 2 acres in 10 (60 million) are in critical erosion condition. Three other acres out of every ten need treatment to restore them to maximum productivity. Conservation work has started on 11 million acres and is planned for another 49 million. But at the rate we are going, we can never expect to catch up with the job. In 1946, only 1.2 million acres were being treated. Meanwhile 73 million acres were getting progressively worse. The cost of treatment is about \$1.50 per acre, and an investment of \$90,000,000 is needed for the worst 60 million acres and another \$110,000,000 for the rest. This work through decreased siltation, ought to save the value of many of the hundreds of millions of dollars invested, and to be invested, in storage reservoirs and power plants.

The final part of the Department's land program deals with getting the underlying mineral resources into use in a manner that will lead to their aiding the national economy. The goal is public benefit through individual development. At present the situation is that anybody can file a mining claim, on public lands, and through a certain amount of work on it, can secure full rights to it.

Under the terms of the mineral leasing act, as amended, the Department is authorized to lease for development lands containing oil, gas, oil shale, coal, potash, sodium, sulphur and phosphate. The terms and manner of lease vary. Generally where the lands are not actually known to contain these minerals, the one who applies for a lease first, secures it. Where the lands are known to contain oil and gas and other minerals, the leases are sold at auction to the highest bidder. Under this plan thousands of acres are now subject to lease for oil and gas, coal and other minerals, and a substantial revenue is returned to the Government through royalties and bonuses (where lands are sold to the highest bidder). The revenues, although deposited in the Federal Treasury, are distributed, 37½ percent to the States, and 52½ percent to the reclamation fund and the remainder is retained in the general fund.

In order to permit exploration by governmental agencies or to reserve deposits for future development, the Department, on occasion, has recommended the withdrawal of certain areas. Because of the intense national interest and security which is involved in the case of radio active materials which are fissionable, the Department has suggested their total reservation in the Government through legislation.

The Department's general policy with regard to withdrawing lands and minerals has undergone revision in procedure, and at the end of the fiscal year was being shaped toward a policy (announced on July 24, 1946, by Department Order No. 2232), calling for careful consideration prior to the withdrawal of public lands, an opportunity for

protest by the individuals or public agencies which may be affected, and public hearing in appropriate cases. A national inventory and cost tagging of the mineral resources on the public domain, referred to in the metals section of this introduction, is, of course, part of the land program.

The Department and the mineral industry have both been perplexed by the effect that the changing conservation technology of both oil and mineral extraction is having on the opening of the remaining public domain. The tradition is against monopolization of the public domain, and that tradition is expressed in laws limiting, sometimes ineffectively, the amount of public domain that can be put into any one hand. Yet good modern conservation practice requires that an oil pool be managed as a unit. Further, the cost of discovering the remaining oil resources is so great, and the geological and geophysical work so complex, that only the larger companies can afford it. They naturally want to protect any discoveries which they may make by securing large land holdings in the area. From the conservation viewpoint the operation of small mineral or coal holdings also creates a situation which may not always be in the national interest. The company or individual which is not well-financed may mine the outcroppings of the coal or mineral deposits and leave the thinner and deeper resources untouched, and perhaps flooded. Under these circumstances, it is difficult for the smaller operators to convert their legal equality of access to the public domain into actual economic equality.

The management of all the minerals in all the Federal lands should be in the experienced mineral agencies in Interior, rather than in several separate Federal Departments. Certain changes in the mineral leasing laws should be considered by the Congress. In Utah and Colorado are large deposits of native bituminous and asphalt-impregnated rock which are now unavailable for exploitation under the mining laws and under the mineral leasing laws. They should be made available, by grouping them with the oil shale provisions of the leasing laws, and may well supply badly needed petroleum resources. The limitation on coal leases of 5,120 acres in any one State should be reconsidered by the Congress. Much of the work on the public domain is under heavy cover, in relatively inaccessible areas, and will inevitably involve high mining costs. Larger acreage will certainly be needed to induce development, and development may be essential whenever we begin pulling on our coal as a source of liquid oil.

Additional prospecting for potash is needed. Present regulations which control the acreage available for prospecting should be reviewed so as to make available a larger area for prospecting without necessarily increasing the acreage available for lease. In the summer of 1946 the Congress increased the acreage which may be held under lease for oil and gas from 7.680 to 15.360 acres. Lessees were permitted to hold,

without acreage charge, options for 100,000 acres in each State for geophysical and geologic exploration. Unitization of oil and gas areas is to be encouraged. Rentals are to be maintained to reduce the speculative element, but during production a royalty payment is substituted.

The Department's conviction that metallic minerals on the public domain as well as oil, coal, and potash should be leased rather than be taken over in fee simple has for some years met the opposition of the mining industry. The mineral and land agencies of the Department believe that the public domain is public property and that the national mineral situation is serious enough to demand that some supervision be exercised over the timing of mineral production. They also believe that some royalty should be paid into the public treasury on wealth located on and produced from the public domain. The industry generally believes that the hazards of prospecting and costs of extraction are already sufficiently high, and that the addition of payments on production is one straw too many, and holds back development. Some plan that would allow a basic net income after all costs and taxes and would provide for graduated royalties thereafter, might make the leasing proposal for minerals more acceptable to those small operators who would settle for a reasonable income instead of a killing.

These five parts make up a sound program for this part of the land. Most of them call for some national investment in order to secure later revenue or to prevent present and later damage, or both. They are based on the experience that the days of getting something for nothing out of the public domain are over. Fires and erosion have to be prevented if we are going to have trees, sage, and water without floods.

A sound rehabilitation program for all the Interior lands in the continental United States, including those without people, would run in the neighborhood of \$300,000,000.

Our Parks

For 30 years it has been the job of the National Park Service to provide for enjoyment of the national parks and monuments and, while doing so, to safeguard "the scenery, the natural and historic objects and the wildlife therein" for the enjoyment of future generations. The estate it manages contains some 20,500,000 acres of land and water.

Before the war, in the travel year 1941, the National Park System had a record attendance of more than 21,000,000, and that record is certain to be surpassed in this first postwar year. Extension of the practice of paid vacations for industrial workers may be expected to add steadily to the number of those who enjoy that part of our natural and historic heritage that is being maintained for them and for future generations.

It is not always easy to defend the park system from invasion by those who wish to profit from the resources it contains. As the remaining merchantable forests dwindle outside, the loggers cast about for excuses to open up the forests in the parks and convert them into saw logs. The stockmen rest envious eyes on the forage of the parks and monuments, while the grazing that survives in them from the days before they were established approaches—but very slowly—the goal of ultimate elimination. The Department and the Park Service alike are concerned over the possibility of unnecessary and unjustified encroachment upon and damage to park areas by some of the many Federal water control projects now in the planning stages.

Within many of our parks there are numerous tracts of privately owned land and it is these private lands, or lands which belong to the States, which offer one of the most serious impediments, not only to adequate conservation measures, but to sound administration and development. The past year has been replete with instances of the menace inherent in such mixed ownership. A proposed sale of Southern Pacific Railway lands in Joshua Tree National Monument would have resulted in disaster to one of the finest portions of the monument; and it is to the credit of the railroad's board of directors that their lands have been withdrawn from sale so that exchanges, or other means of acquiring them, may be undertaken. One hundred thousand feet of beautiful pine timber was cut on private lands in Glacier National Park; and there is the constant threat of the sale of a large block of State-owned timber in the same park, though the State authorities are sincerely anxious to work out some means of assuring its preservation.

A request for \$350,000 to be expended on the purchase of some of the most needed of these non-Federal lands was made to the Bureau of the Budget and was approved by the President, but neither the House of Representatives nor the Senate approved it. Opposition to further Federal land acquisition, with the consequent loss of taxes to local units of government, was the principal reason. It demonstrated again the need of legislation that would permit the apportionment of a part of the earnings of the National Park System to the States for distribution to the counties in which the areas are situated. The necessity of a continuing program, on an adequate scale, of acquiring these inholdings is beyond dispute. The longer it is delayed, the more expensive it will be and the more valuable resources will be irrevocably lost.

A cardinal principle in the National Park Service's planning for public use and enjoyment is that developments in the parks and monuments shall be limited to those needed to accommodate the public and to permit visitors to obtain the fullest measure of enjoyment of those features that give distinction to the areas. A corollary is that these developments shall

intrude as little as possible upon the natural scene, particularly if it be one of extraordinary quality. Admittedly, certain developments now to be found in the park system violate these principles; most of them date back in their beginnings to the period before the creation of the Service. However, they represent an investment still valuable in meeting the requirements of the public; consequently, their ultimate elimination, and replacement in more suitable locations, is bound to be a slow process, though the objective is one to be kept constantly in mind.

Just as it is not always easy to defend the parks against invasion, so it is not always simple to make them serve adequately the purposes for which they were established. During the war, equipment and facilities, for Government and concessioner alike, deteriorated due to lack of funds and manpower. With the resumption of peace-time operations, eating, sleeping and other facilities have been overcrowded. With only a few exceptions, these facilities are provided by concessioners who operate under contract with the Government and, for the system as a whole, they are far from sufficient. Additional hotels, lodges, cabins and eating places must be provided to care for all but the extreme peak loads, and of kinds that will enable those of moderate means to enjoy their great possessions, though it will doubtless require the devotion of more space to such developments. The alternative is a degree of crowding of existing facilities, already frequent in several of the major parks, that seriously impairs their capacity to provide enjoyment.

Convinced that it would make possible an improvement in service to the public, it is the approved departmental policy to work toward Government ownership of all facilities in the parks, and the operation of them for use by visitors through contracts with nonprofit distributing corporations or with private enterprises for periods of reasonable length, with careful regulation and periodic review of these contracts to determine that they are in the interest of the Government and the public, and are fair to the concessioners.

It should be obvious that the concessions exist for the benefit of the parks, and not the parks for the benefit of the concessions. By this is meant that the provision of accommodations, eating places, transportation and other public services is a means to an end. The concessioners are in the parks for the sole purpose of providing service to the public and not because the parks are fruitful places in which to do business. The services are limited to those which the visitor has a right to expect in a national park. The concessioners, under their contracts, are serving the people no less than the ranger forces, the naturalists, or anyone else, in fulfilling the purposes of the national parks.

The policies of development and management are the outgrowth of years of experience in protecting the park areas and making them per-

mently available for human enjoyment in unspoiled condition. All these, it is believed, have proved their soundness, and are generally accepted by the people who visit the parks as being in the public interest. Not change in these policies, but provision of the means of making them more fully effective, is what is needed to make the parks more useful to the public.

The National Park Service well knows that to change the basic policies governing the national parks might provide within them a few more "recreational areas." However, such changes would lead to undue and unnecessary impairment of natural conditions in areas that were created to preserve outstanding remnants of North America's primeval wilderness for the enjoyment and inspiration of ourselves and future generations. These would increasingly become centers for kinds of outdoor activity that are already being provided for elsewhere, or that can more appropriately be provided on lands of lesser caliber.

Another phase of park management that presents a difficult problem is that of winter use. Mount Rainier, Olympic, Rocky Mountain, Glacier, Yellowstone, Sequoia, Yosemite, Lassen Volcanic, and others put on a wholly different appearance, and one certainly no less beautiful, with the coming of winter's snows. If it is possible to do so without an expense out of proportion to the advantages to be gained, the public should be encouraged to visit and enjoy them in winter and to take advantage of the opportunities they offer for healthful enjoyment of the out of doors at a time of year when too many people spend too much time indoors.

However, during the winter months schools and colleges are in session and relatively few persons take their vacations then; consequently winter visitation tends to take the form of week-end peak loads, with comparatively few visitors during 5 days of the week. It is easy to see what difficulties in the operation of public accommodations these facts involve. Added to this is the heavy expense of keeping open the roads which lead to such places as Paradise Valley in Mount Rainier National Park. Last winter most such roads had to remain closed because the Service simply did not have the funds to open them. At Mount Rainier, a special supplementary appropriation made it possible, though under extremely difficult conditions, to open the road to Paradise. At Yosemite, regular funds were barely sufficient for keeping open the road to the Badger Pass ski area. How far the Government should go in subsidy of this important type of park use, is one of the problems worthy of much more study and analysis.

Imposing though attendance figures for the national park system may be, only a tiny fraction of the more than 140,000,000 Americans who own the parks have the time and the means of really knowing their parks well at first hand, or ever will. Yet they exist for the enjoyment

of the people. Even those Americans whose opportunities for first-hand enjoyment of these extraordinary properties is limited, have reason to take pride in the fact that they possess them. But if they are to provide the fullest possible measure of enjoyment, they must be taken to those who cannot get to them. An obligation rests upon the Federal Government to take advantage of the exciting and effective techniques of color photography which have been developed during the past decade and to see to it that there are ample opportunities for every school child and every adult, if only through effective visual presentation, to enjoy the beauty of the parks and to grasp the significance of the historic and prehistoric places and objects that are safeguarded in the park system, through effective visual presentation.

That task is a challenge. In its accomplishment, there are opportunities for many persons and many organizations to participate, and they should be made aware that they exist. But it is primarily a responsibility of the Government itself, which should be recognized and given the comparatively small financial support which is required if it is to be met in a satisfactory manner.

The Fish in Our Future

Perhaps the greatest untapped fishery resource in the world, and one which could be made available to American enterprise if it were fully explored, is the fish supply of the Central Pacific and particularly the tunas which, pound for pound, are the most valuable of sea fishes. The tuna fishery of the Pacific coast from Washington on the north to the Galapagos Islands on the south has grown since 1915 into one of the great sea fisheries. In the Western Pacific the Japanese tuna industry has shown comparable development. Japan's attempt to explore and utilize the tuna resources of the mandated areas was effectively stopped by the war. The extent of these resources in the Central Pacific has never been measured. Hence their development presents a virgin field.

The plans for the rehabilitation of the fishing industry in the Philippines, including the exploration and assessment of offshore fishery resources, form an important link in this program. If pending legislation in Congress for cooperative fishery investigations and development in the Territory of Hawaii is enacted, this crossroads of the Pacific will provide an additional field base and will serve as another link in the developing research program. The final step will be the organization and conduct of tuna investigations in the eastern temperate Pacific and in the equatorial regions coordinating these initial efforts. With the realization of these plans, which include the fuller utilization of the fishery resources fringing the Gulf of Alaska and in the Bering Sea, the food resources of the Nation will be expanded materially.

For the next 2 years, at least, efforts will be made to increase the salmon stocks in Alaskan waters by surveying the coastal spawning streams and by removing in several hundreds of them, obstacles or complete barriers to fish migration which prevent full utilization of otherwise suitable spawning areas. Such barriers to migration as log jams, low falls, and other obstructions will be removed and, where economically feasible, fishways will be constructed, thus opening up miles of additional spawning area. If the available spawning grounds can be increased by 10 percent and the salmon stocks increase proportionately, the expenditure of a few hundred thousand dollars now will add more than 5 million dollars to the commercial fisheries of the Territory.

Meanwhile, more scientific data are necessary by which to improve the accuracy of determining optimum catches and escapements, and to formulate regulations for achieving a proper balance between catch and escapement. Of the counting weirs that are necessary in about 40 representative spawning streams in Alaska, funds are available for installing only 7. Our law enforcement facilities must also be expanded in accomplishing a more effective management program. Fast patrol boats and planes are badly needed to cover 10,000 miles of Alaska coast line.

The fishing industry was more or less dislocated by war-time conditions. Owing to shortages of labor, equipment and materials, and to depressed catches of some species, the production of canned fishery products decreased from 1941 to 1945. It has still not reached pre-war levels, and is insufficient to meet domestic demand. At the same time, under the stimulus of high prices and the relative scarcity of other protein foods, the production of fresh and frozen fish increased, and the frozen fishery industry expanded considerably. During the war period, the demand for these products was almost unlimited. But this demand was transitory, for the war's end released to the public competing products like meat and imported frozen fish; so that by the summer of 1946, holdings of frozen fish in cold storage warehouses were higher than they had ever been in any previous summer. Meanwhile, the production of fish meal and oil was depressed during the war in favor of canned goods, and as a result, supplies are far below current agricultural needs.

More serious than any of these effects, however, was a general decline in the quality of fishery products in many places where the demand was keen enough to result in relaxation of standards. The consequence of this is that imported fish is frequently superior to that produced domestically and can compete successfully with it.

These problems of the fishery industries are very much the concern of the Fish and Wildlife Service, for the full and proper use of a resource is an important phase of the conservation of it. We believe that solution of the industry's problems and readjustment to a peacetime economy

can be most quickly achieved by raising the standards of quality and by increasing the efficiency and economy of operation. This is fundamental to enlarging the market. Consequently the Fish and Wildlife Service will continue and intensify its research into methods of improving fishery products and developing new ones. For the first time in 1946 it has the educational facilities for demonstrating to members of the industry—fishermen, processors, and dealers—methods of getting the most and the best out of their raw materials. It will make readily available the most advanced methods of fishing, processing, shipping and distribution.

As the products improve, another program of the Fish and Wildlife Service is directed toward enlarging the market for them. This is being accomplished by educating the public to appreciate the nutrient value and edibility of their fishery resources.

Among the various influences which have been brought to bear on fish and wildlife resources during recent years, none is so far reaching as the water utilization program. This involves projects on rivers to provide irrigation, navigation, hydroelectric power, flood control or other benefits. It also involves the construction of dams, locks, levees, and other structures which disturb to some degree the status of fish and wildlife in and around the project areas. Because some of these will occupy the habitats of some of our most important native food and game animals, the Fish and Wildlife Service has established a staff of scientists who work with the Bureau of Reclamation and the Corps of Engineers to obviate or minimize damage to these resources, or to take full advantage of any facilities that might serve to increase them.

This job is not a simple one. The river bottomlands are generally the areas most prolific of wildlife. They are frequented by migratory waterfowl and many kinds of upland game, especially during the winter season. If adequate measures were not taken in advance, a series of reservoirs in a valley could destroy the entire supply of winter cover on which deer and certain game birds depend, and thus eliminate the animals themselves.

Certain projects proposed in the comprehensive plan for the development of the Missouri River Basin will have a deleterious effect on important waterfowl nesting refuges in Montana and the Dakotas. These areas will have to be duplicated as nearly as possible with areas of equal value, improvements, and water facilities for wildlife needs.

Meanwhile, the Fish and Wildlife Service is working to develop methods of utilizing the structures that are being built. Reservoirs are viewed from the standpoint of their future use for the production of sport and commercial fish, as State or Federal migratory waterfowl refuges, and as public shooting grounds. We are working to increase fish and wildlife habitats through practical modification in the structure

and operation of reservoirs. Thus projects can often be changed from the debit to the credit side of the evaluation ledger, from the standpoint of animal resources. It is not enough to insure maximum production of fish and game by incorporating sound biological considerations in the development plans. These resources must be managed after construction and impoundment. Only this combination—suitable habitat and good husbandry—will produce and sustain fish and game crops on the land and water areas affected by the national river development program.

Wildlife Conservation

The size of the waterfowl crop depends on many factors, of which the length of the shooting season and the bag limit are only two. The many vicissitudes of nature are of great importance. In 1945 and again in 1946, droughts dried up vast areas of the Canadian prairie provinces and reduced or destroyed the breeding value of about 45,000 square miles of key territory. In addition rains and a spring blizzard in New Brunswick and Nova Scotia destroyed many ducks. As a result of these factors, fewer wildfowl were produced in 1945 than hunters shot the following season; and the total wildfowl supply declined to about 64 percent of what it had been in 1944.

The future supply of waterfowl depends on the kind of management we give it. While barren years like the last two will eventually be offset by fertile ones, the number of hunters will continue to increase. This is an important factor in the problem of managing the waterfowl resources, and will put a premium on our having an accurate estimate of the size of the harvest. It will also put a premium on the coverage by our law enforcement officers. To accomplish this estimate and coverage, we must have a corps of at least 150 well-trained and fully equipped United States game management agents, who will work in close cooperation with conservation officers of the various States.

For migratory waterfowl, we apply two principal and essential conservation techniques: First, we limit the number of birds that hunters may harvest each year; second, we maintain a nation-wide system of refuges, which have been strategically located to give the birds rest, food, and shelter during their long seasonal voyages, and protection on their breeding grounds. The value of this system continues to grow each year as the acreage of water has become stabilized to assure a steady optimum production of aquatic food and plants needed for nesting. The continued orderly development of the refuge system is an essential feature of our design for waterfowl restoration and maintenance.

What is true of waterfowl is true, on the whole, of other game birds. For example, the ring-necked pheasant has suffered a serious decline in abundance over much of its range, and especially in the Midwest. This

is the consequence of a series of several years of weather unfavorable to nesting and brooding. For the same reason, the bobwhite quail population has been sharply reduced in parts of the northern limits of its range; and the ruffed grouse too is at a low ebb of abundance.

The status of big game is generally favorable. The diversion of hunters to military duty or to wartime industrial occupations, the reduction in the supply of sporting arms and ammunition, and restrictions on travel, all helped to conserve and even restore game. But war conditions were not everywhere without ill effects on game. Hunting pressure tended to be intensified and concentrated near large centers of population, war industries, and military establishments. Some game ranges which were included in maneuver areas and artillery or aerial bombing ranges suffered severe damage. In such areas, the recovery of the vegetative cover to their prewar carrying capacities, and the restoration of the wildlife populations will be the work of several years. Numerous areas acquired by the military services as temporary bases are, or will be subject to disposition. Many could be developed into excellent wildlife refuges or management areas.

Hopes for prompt renewal of more effective predator and rodent control work after the war were dispelled by delays in reconversion, which hampered acquisition of badly needed equipment. A little progress was made, however, by increased use of recently developed control methods. Several of these, including the famous rodenticide, Compound 1080, are still in the trial stage, but will probably be released for carefully controlled operational use in the near future.

Basic Indian Problems

The basic Indian problem confronting the Government is that of a low-income group operating on a small resource base, under a peculiar combination of independence, dependence, and separation. In many ways this basic problem and the many others growing out of it are similar to those of the peoples living in underdeveloped areas throughout the world. These peoples do not want the low standards of health and education that go with agricultural poverty. They want a better land base, better techniques of resource development, more industrialization—everything that will give them a chance to participate in the economic progress of the world; or, for the Indians, an opportunity to share in the rising standard of living of the Nation as a whole.

During the last decade, the Indians have made considerable progress toward the goals of self-government and economic independence. As a nucleus they had only the meager land base left to them after almost half a century of the allotment policy, under which the Government had allowed and encouraged the allotment of tribal lands to individuals and the subsequent alienation of some 80,000,000 acres of Indian land.

Lost in this manner was much of the better land which they had retained under various treaties with the United States.

Beginning with the Indian Reorganization Act of 1934, the national policy changed to one of protecting the remaining tribal resources, replenishing the resources base on which to build economic independence, and reestablishing the authority of tribal councils. The new policy has been implemented through purchase of additional lands, through better management of agricultural, range, and forest lands, and through the establishment of various industrial enterprises to utilize tribal resources, such as timber and minerals. Coincident with these economic phases of the program were the equally important programs in the fields of health, education, and tribal self-government. For little progress could have been made by a people in poor health with a high rate of illiteracy.

While there is ample evidence on all reservations today of the strides which have been made in the economic, health, and education fields, there is almost equally plentiful evidence of the need for the continuation and, indeed, the expansion of the various programs, if the Indian is to assume his rightful place in the Nation. The most urgent aspects of the problem and the steps being taken by the Indians and the Indian Service to alleviate the situation are briefly summarized in the following paragraphs.

Underlying many of the Indians' problems is a generally low health level which shows up clearly in the high rate of infant mortality. While only 2 in every 50 babies in the Nation as a whole die in the first year of life, 2 or 3 in every 10 Indian babies are thus doomed.

The correlation between low income and poor health is aggravated in the case of the Indian population by its historic lack of resistance to tuberculosis. Although the fight against this disease among Indians is never relaxed and a high rate of protection has been achieved during the past 10 years through persistent experimentation with antituberculosis vaccine (BCG) the incidence of the disease itself is still five times higher among the Indians than among the people of the United States as a whole. In Alaska where the Indian tuberculosis rate is even higher than that in the United States, the Indian Service has recently acquired the Sitka Naval Base which will be converted into a 200-bed tuberculosis sanitarium and a boarding school for 600 pupils.

Many other diseases, particularly those of the digestive tract, also take a high toll of life. The incidence of trachoma, however, formerly a prevalent disease among the Indians, has been greatly reduced, largely through the use of sulfanilamide, the effectiveness of which as a remedy for this disease was discovered by the Indian Service medical staff.

The Indian Service health program has been seriously handicapped during the war years by a shortage of doctors and nurses to staff the 76 hospitals and sanatoria and the field medical positions. Even after

large-scale demobilization by the armed forces, many doctors and nurses have failed to return to the Indian Service because only limited tenure could be obtained. Establishment of civil-service registers in these fields and permanent appointments made therefrom should help to alleviate the shortage in trained personnel.

The Indian Service is confronted with many problems of education—both in the narrow sense of school rooms for children and in the broader sense of helping the tribe to make the optimum adjustment to its particular circumstances. The shortage of physical facilities is most acute on the Navajo Reservation, where there are schoolrooms for only 6,000 children, or for only 30 percent of the 20,000 children of school age. On that reservation the problem includes finding the proper compromise between day schools, which are best from the educational viewpoint, and boarding schools, which are more practical because of the long distances children must travel to school and the lack of all-weather roads. More than ever before, however, the Navajo Indians themselves are pressing for more education and are cooperating with the Indian Service in attacking the problem. They have not only consented to, but encouraged, the sending of several hundred children, aged 12 to 14, to schools in Albuquerque, N. Mex., Riverside, Calif., and even to Chillico, Okla., where special courses have been designed to teach English and elementary subjects simultaneously.

Although expanding its facilities in areas like the Navajo where no alternative school services can be secured, the Indian Service follows the definite policy of utilizing State schools wherever feasible, paying tuition for the children under various types of contracts. Additional contracts are constantly being arranged.

Under education in the broader sense, many of the Indians are faced with the necessity of adjusting their economic, social, and spiritual ways to the fast tempo of modern American life. The transition from the nomadic hunting economy which died suddenly when the buffalo had been killed off and from the primitive subsistence agriculture which was disrupted when non-Indians put up fences and took most of the good land, has not been completed. One result of this situation is that many individuals have not learned how to utilize to best advantage the returns which they have earned in their new society. Thus there are tribes where the average family income compares favorably with that in a similar non-Indian community but where the Indian housing and health standards are definitely inferior to those of the non-Indian. It is, therefore, the task of the Indian Service to help the Indians acquire the knowledge, skills, and motivation which they need in completing the difficult adjustments in their living and thinking habits.

There is today a considerable movement of Indians to and from the reservations. During the war many went into the armed forces. Many

others found employment opportunities in war work outside the reservations. The contrast between the high reward for such wage work and the return which they had received on the reservation was great. Although some Indians have remained away from their homes, a majority have returned either because their war jobs were terminated or because they preferred reservation life. Some returned home for a brief period and then departed again to seek further wage work. The present picture, indeed, is far from clear, and constitutes a real problem for the Indian Service in its attempt to promote Indian welfare in general. For while the Service encourages off-reservation employment under good conditions as a partial antidote to the inadequate resource base of many tribes, it also foresees the danger of industrial or rural slums where adequate housing and health standards are not maintained. It is consequently the policy of the Indian Service to work closely with State and local organizations in preventing the growth of such slums. In this connection it is recognized that off-reservation employment opportunities will vary with the economic state of the Nation, with an inevitable movement toward such employment when jobs are plentiful and wages high. It is nevertheless hoped that the number of permanent migratory laborers can be held to a minimum. Indians who settle either on or off the reservation should obtain greater financial security as well as better education and medical facilities for their families.

One possible remedy for the inadequate resource base possessed by many of the tribes would be the continuation of the land acquisition program. This course of action is, in fact, being carried out by the Indian Service, although, for reasons stated below, on a much smaller scale than during the years preceding World War II. The basic obstacle to large-scale land purchase by or for the Indians is the ever-increasing demand for land of all kinds by the expanding population of the Nation. This is reflected by the increase in the price of land during the war years. In the 17 States where most of the Indians are located, the price of farm lands went up by 54 percent and the price of range lands by 75 to 300 percent between 1940 and 1945. Another obstacle to a land acquisition program is the opposition to Indian purchases as indicated by the limitation in the present appropriation act which prohibits the use of either tribal or Federal funds for the purchase of lands outside reservations in several Western States. There is equally strong competition for every drop of irrigation water which is needed to grow crops in most parts of the West. Consequently, there are instances where the Indians own large acreages of irrigable land which cannot be fully utilized, at least under current water policies, because of an insufficient supply of water. An important task of the Indian Service is the protection of Indian water rights in several key areas including the Colorado River Basin.

Although present land areas are definitely inadequate for some of the tribes, there are many reservations where the program should be better utilization of the existing acreage rather than the acquisition of more land. Here the Indian Service must continue to help the Indians improve their agricultural and stock raising technique. This problem is related to that of general adjustment mentioned above.

One method of improving land utilization is the consolidation into economically usable units of small plots of land which are the result of divided inheritance. One hopeful example of such consolidation is the program on the Rosebud Reservation in South Dakota where more than 20,000 acres of small scattered parcels of land were exchanged by the individual owners for shares in the Tribal Land Enterprise, which manages 60,000 acres and pays dividends on its shares.

Another possible method of compensating for the inadequate resource base is the diversification of the economy of some of the Indians. Industrialization, for example, would lessen the present overload on certain reservations. A study is now being made of the Navajo Reservation to determine what industrial possibilities exist for Indian production of raw materials, semifinished and finished goods. The Navajo sawmill now ships all its product off the reservation as timber, although it is quite possible that the Indians could profitably convert at least a portion of it into wood products such as sash and doors. Indians employed in such work would no longer depend upon the overtaxed agricultural and stock raising resources of the reservation. Similar possibilities are being investigated on many reservations not only in the industrial field but also in mining, arts and crafts, and tourism.

It is the belief of those in the Indian Service responsible for helping the Indians plan for the future that the maximum benefits will be gained in the immediate future through a combination of improving the utilization of their present lands, acquiring additional lands where available, and diversifying their economy wherever possible.

Wherever plans or programs affecting Indians are formulated, there is always to be considered the net annual increase in the Indian population of the country. The group which now numbers approximately 400,000 is increasing at a rate of 1.2 percent annually, compared to a national rate of 0.74 percent. This increase has been made in spite of the high infant mortality rate and disease rates mentioned previously.

An important aspect of Indian Service work in Alaska is the clarification of the status of Native land in the Territory. There are a few Native reservations similar to Indian Reservations in the United States, but most of the natives live in villages where title to the land has never been formalized. During the last half century the natives have been gradually forced out of some fishing and hunting areas which they and their ancestors have used since time immemorial. As the natives are

largely dependent upon their land and water resources, the Indian Service is helping them in their attempt to hold or regain those lands to which their claims of possessory rights are justified. The settlement of the land status will be advantageous to both the natives and non-natives of the Territory.

A major problem facing the Indian Service today is that of public relations in the broadest sense. In order that the Indians may be accepted as American citizens, in fact as they were by law in 1924, there must be a much wider knowledge of the facts on the part of the American public. Indians will not be fully accepted while so many people are under the false impression that Indians are forced to live on reservations. There will likewise be no equality for Indians when they are barred from stores and restaurants in communities near their homes and when they are not hired on the same basis of non-Indians. The States of Arizona and New Mexico still bar Indians from voting, although it is hoped that cases now before the courts will remedy this unfortunate situation in the near future.

In order to deal more effectively with the complex problems outlined above as well as many others, the Indian Service has made several significant changes in its methods of administration. Basically these changes are designed to simplify Indian Service procedures, many of which had become extremely complicated since the Bureau was established in 1824. Many questions of local interest only were required by law to be referred to Washington for an answer. As a remedy for this situation, the Secretary of the Interior, under authority of the act of August 8, 1946, has delegated to the Commissioner, and the Commissioner, in turn, to lesser officials various powers and duties originally assigned by Congress to the Secretary of the Interior. A second step toward simplification was the establishment of five district offices in Minneapolis, Minn.; Billings, Mont.; Portland, Oreg.; Phoenix, Ariz.; and Oklahoma City, Okla. To the directors of these offices has been delegated the authority to make many of the decisions which would formerly have been referred to the central office.

Another event of great importance was the enactment by Congress of the Indian Claims Commission Act, in the summer of 1946. The Commission of three members, created by this act, will hear, during the next 5 years, all claims of Indian tribes against the United States. Within 10 years from the date of passage of the act, the Commission will pass upon the validity of each claim and make recommendations to Congress as to its settlement. The creation of this Commission constitutes a major step toward the solution of the complex problem of Indian claims which has for many years clouded the relationship between the Government and numerous Indian tribes.

Problem Areas

The Department of the Interior is interested in several problem areas. These include such differing localities as Alaska, where a small population and large prospective resources have not yet created an expanding economy, and Puerto Rico, where a very large population is living on a very low level under a peculiarly one-sided agricultural economy. They include areas of devastation, such as the Rio Grande Valley, and rich areas such as the sugar and pineapple lands of Hawaii where there is some danger that high fertility may be lost under the impact of mechanization. The underdeveloped areas resemble some problem areas of the mainland, such as that part of the Missouri Basin which has been losing population. Parts of the Southwest and of Hawaii still require an industrial balance for the agricultural bull wheel of their economy.

In all of these areas the Department has the same type of concern for resource development and a higher standard of living that the Department of State and the United Nations have for the underdeveloped nations beyond our borders. The Interior Department's interest is more direct, because these areas are part of the United States. Alaska's development carries with it many of the hopes of the whole Pacific Northwest. Puerto Rico's development, for better or worse, exemplifies to all the Carribbean countries and many other Latin-American countries the net product of the American economic and political system. Our influence in those countries, including their supply of raw materials to us and their purchase of our products, is affected by their judgment of our conduct in Puerto Rico.

Alaska is a self-governing territory, with a Governor appointed by the President. Its present population is approximately 90,000, including some 33,000 Native Indians, Aleuts, and Eskimos. Its industrial development has been confined to mining (largely gold), some lumbering and a large fishing and canning industry. Gold mining was almost completely curtailed during the war, while lumbering was considerably expanded. There are good prospects for all of these industries. The potential pulp and paper industry needs hydroelectric power to get started on the large coastal forests. The potential power sites that would best serve this industry and also the Alaskan communities are reasonably well known. The fishing industry can expect to increase as it goes into the taking of crabs and various ground-feeding fish that have so far been neglected. The mining industry is giving increased attention to the less valuable but industrially more important minerals, such as mercury, chromite, antimony, and limestone, as well as the local demand for coal.

The possibility of a large tourist business has excited the interest of many Alaskans. The road system is not wide flung but is being expanded. Ship rates for passengers and freight transportation to Alaska,

as well as rail and air rates within the Territory are high. Because of the limited passenger facilities on the coastwise steamships serving the Territory, the wonderful scenery and recreational opportunities of Alaska are not bringing the number of vacationists that were attracted before the war. There is no other way for tourists to reach Alaska. The establishment of scheduled air services and the construction of the Alaska Highway will open new routes of travel capable of transporting a far larger volume of vacationists than the steamship lines were ever equipped to handle. The urgent present need is for lodges, hotels, and recreational centers to be developed within Alaska to accommodate the great number of tourists who will take advantage of Alaska's vacation attractions as soon as they can find accommodations. Steamship facilities, too, need to be expanded and improved in order to provide space for cruise passengers and to build the Alaska tourist industry to the limit of its possibilities.

The prospect for a large influx of settlers now appears to wait on an increase in industrial opportunities, lower living costs, opening up of public lands which were withdrawn for one purpose or another during the war, and materials for housing. The agricultural opportunities seem to be dependent on a great deal of preliminary land clearing or drainage work. The disputed attempt of the 1930's to establish an agricultural settlement, the Matanuska Valley Farm Colony, proved to be justified by the war. Shipping space for farm products was saved. The Matanuska farmers made large profits. The settlement is now on a going financial basis.

The Division of Territories and Island Possessions in the Department deals with Alaskan problems. It believes that programs for Alaska should be developed cooperatively by the Federal and territorial Governments. Its opinion is that if there were a national economic emergency that required public investment, several hundred million dollars could be spent profitably on public works which would develop the Territory's resources.

Puerto Rico presents the complex of a steadily increasing population with a decreasing standard of living, based essentially on the production of a major crop, sugar, for sale to the United States. Its present population is 2,100,000, 23 times that of all Alaska, and by 1960 another 600,000 persons may be added. The available land for cultivation is limited to a million acres, or about one-half acre per person now. This will be about one-third acre in 1960. It compares with 4 acres of arable land per person in the continental United States. Puerto Rico's main crop, sugar for sale on the mainland, is, of course, subject to the fluctuation of sugar prices and quotas. It is also subject to the cataclysmic potentialities of synthetic sugar substitutes. The result is

that the Puerto Ricans import \$37,000,000 worth of food. The manufacturing opportunities have as yet been so little developed that the island imports \$160,000,000 of other merchandise and commodities annually.

Development of Puerto Rican industries has been attempted in recent years. Cement, glass, boxboard, clay products, and shoe manufacturing plants have been established, but only 14 percent of the working population is employed in industry at present. Its income, while low, is still considerably higher than the income of the farming population. The average family income at present is about \$350 a year, which is still lower than that of any one of the United States. The economic future of the island is linked with its political future. Tariffs, subsidies, credit aids, freight rates, are all tied up together with its political position. While the Governor and certain other officials of the executive and judicial branches of the insular government are appointed by the President, the legislative branch, consisting of a House and a Senate, is popularly elected.

The Division of Territories and Island Possessions believes that development programs must come principally from the island government. The Insular Government of Puerto Rico is aware of its needs and has developed an outstanding long range planning program as a guide to raising the substandard conditions in health and school facilities, sanitation and water supply, roads, etc. This plan shows that \$344,000,000 should be expended to bring conditions up to a minimum decent standard. Of this amount, the insular government plans to provide about \$55,000,000 during the next 6 years.

It is estimated that at least 8,000 new houses should be provided annually to take care of its population increase, and over 300,000 houses that are now substandard should be replaced at the rate of 15,000 per year for the next 20 years to eliminate the serious urban and rural slum conditions now existing.

The Virgin Islands, although much smaller, having a population of about 25,000, present similar economic and social conditions to those of Puerto Rico.

Here, too, a lack of natural resources is a limiting factor to industrial expansion, and agricultural development is precarious. It appears likely, however, to some students, that the tourist trade can be developed to a point where the existing deplorable conditions can be raised to a decent standard.

From the resource viewpoint, Hawaii has done far better than Alaska or Puerto Rico. However, less than one-tenth of the total land area is reasonably suitable for agricultural use, and about one-third is usable pasturage. The ownership of the land is highly concentrated. In-

creased mechanization in connection with the harvesting of sugar cane which was resorted to by the plantations as a result of labor shortages and increased wage rates, has accelerated the depletion of soil fertility. Removal of the topsoil by "grab loading" and erosion seems to be an inevitable result of the replacement of hand planting and hand harvesting by the use of heavy equipment. The pasture lands also suffered from wartime overgrazing.

The war also brought with it new insect pests that are an additional menace to plants and fruit trees. The water situation became acute both in the cities and in some of the rural areas. In Honolulu water consumption doubled between 1940 and 1945. Legislation making all ground waters public property is being considered. Reclamation projects are being studied, with a view to bringing additional lands into cultivation, especially for the growing of fruits and vegetables.

The Department of Agriculture and the Territory are undertaking a project to protect cropland by cover crops and erosion controls and to plant appropriate grasses on the ranges. Studies of offshore fishing possibilities are being strongly urged by the Territory.

The increasing population in Hawaii presses heavily on the land, creating housing and land redistribution problems of some magnitude. The Division of Territories and Island Possessions recommends effective long-range planning to overcome these problems, especially a thorough survey of land utilization possibilities.

Far more severe than the resource problems of Hawaii are those of the Rio Grande Basin. Extending 1,800 miles in length and including 185,000 square miles in Colorado, New Mexico, Texas, and the Republic of Mexico, this river valley presents an outstanding case where a high degree of coordination is needed to deal with the development, use and conservation of the natural resources. This basin, with a population of nearly a million people in the United States portion, which is predominantly dependent on irrigated agriculture, range livestock, mining, and tourist trade, is facing ruin unless the destruction of the land and water resources, caused principally by erosion and sedimentation now going on apace is reversed and corrected.

The threat to this region comes from the neglect and break-down of the vegetation and soil on the watershed under the strain during the past 75 years, of continued and severe grazing and other land-wearing activities of man, and rodent infestation coupled with recurrent drought. In this semiarid section, vegetation has a precarious foothold at best, and the soil, once its protecting mantle of vegetation has been weakened, is highly susceptible to erosion by run-off from rainfall, which is often concentrated in torrential downpours. The soil, loosened from the slopes and valley bottoms of the drainages, is being washed into the main stream and major tributaries where it is clogging channels, con-

tributing to floods, waterlogging the rich valley agricultural land, and filling the storage reservoirs at an alarming rate. Extensive areas in irrigated sections have already become waterlogged and forced out of production, and now require new drainage systems, or rehabilitation of old ones. Others lack sufficient water storage and regulation facilities. Existing irrigation works in some districts require rehabilitation. Virtually the entire basin is in urgent need of flood control. Low-cost hydroelectric power is essential to the further development of the resources of this region. The entire area lacks adequate recreation and fish and wildlife facilities. Rehabilitation of the grazing lands is essential not only to the control of erosion, but also to replace a sound foundation under the range livestock industry.

The situation is the most serious in the New Mexico section of the main Rio Grande, and its principal tributary, the Pecos River.

There are two major aspects of the basin problem. These are management and related measures to correct and improve the conditions on the watershed lands where the sediment originates, and the construction and operation of dams, canals, drainage systems and other developments on the main streams and major tributaries to regulate the water supply and impound silt that cannot be withheld on the watershed or has already reached the main streams. These two features overlap, are interdependent and must necessarily be worked out together in an integrated over-all program for the basin.

The formulation and carrying out of the over-all program necessary to meet the situation is complicated and delayed by many factors. There is a need on the part of the local people to appreciate more fully the gravity of the problem, especially the land-water-people relationship in the area. This relationship is more sensitive to mistreatment and more vital to human welfare in the Southwest than elsewhere in the United States. Divergent views and interests need to be clarified and reconciled. Overlapping jurisdictions—Federal, State, and local—need to be harmonized. It is abundantly clear, however, that if the destructive processes which began scarcely more than 75 years ago (although irrigation was begun by the native people several centuries ago) are not halted and reversed, the present day engineering developments for reclamation, flood control and power works will be short-lived, and much of the whole economy and social structure based on the land and water resources, in a matter of time will be overwhelmed and destroyed.

An elementary need to achieve progress in the solution of the present problem and the further sound economic development of the land, mineral, water and power resources of the Rio Grande Basin, so far as the related Federal activities and responsibilities in the area are concerned, is the establishment on the ground of Government machinery

that will result in a coordinated unified approach on the part of all of the Federal agencies involved in the formulation and carrying out of an adequate over-all program. At the present time several Bureaus of the Department of the Interior, several Bureaus of the Department of Agriculture, the Corps of Engineers of the War Department, the Federal Power Commission, and the International Boundary and Water Commission, United States and Mexico, have important functions and responsibilities in the basin to the land, water and other natural resources which need to be harmonized and directed to a common end.

Of equal importance in the Rio Grande basin, as in other river basins of the country, is the provision for participation in any program undertaken in whole or in part by the Federal Government, by State and local governments and other bodies of citizens both in the development and carrying out of any such programs to the end that whatever is accomplished will represent the combined interests of all concerned.

The Department of the Interior is now making a special effort and study to push its plans and meet its responsibilities. It stands ready to cooperate to the limit in the development of machinery that will result in a coordinated approach of all agencies concerned in meeting this most urgent situation in the Rio Grande basin.

Regionalization

During the past years it became evident that efficient administration required the field and area offices of the various departmental agencies to assume more responsibility. Continued concentration in Washington of key technical personnel was found to be undesirable, as well as contrary to the wishes of the Congress, which usually puts limits on the amounts of each appropriation that can be spent in Washington.

Regionalization, in the Department's thinking, means something different from simple decentralization. During the war the National Park Service, the Office of Indian Affairs, and the Fish and Wildlife Service were all located in Chicago. Prior to that, the main office of the Bureau of Reclamation was located in Denver, and the main office of the Grazing Service was in Salt Lake City. That was decentralization in the simple form of administration outside of Washington. However, it was not conducive to the assumption of responsibility by field offices in the river basins or other areas. Regionalization, as the Department understands it, involves putting able men close to the problem with which they are dealing and giving them sufficient authority so that, with technical guidance, they can carry out their duties. It involves the establishment of a local agency which could deal locally with certain types of problems effected by Federal responsibility. It would relocate the focus point of certain Federal powers and functions already in existence.

so that they would be carried out on the home grounds, instead of being performed in Washington. The creation of a regional development body merely transfers existing Federal authority to the grass roots. It would not replace the Federal agencies performing functions in an area which are clearly a part of a great national program.

The Department has moved slowly in the direction of regionalization of a much less ambitious type than the Secretary's proposal for a regional river basin administration in the Columbia Valley. Within the last few years, the Bureau of Reclamation has established seven regions. The Office of Indian Affairs has recently created five field districts. The district manager in charge of these areas receives a large delegation of powers from the Commissioner and is directly responsible to him. It is believed that decisions can be made more rapidly in this way. The Bonneville Power Administration, with its headquarters in Portland, has been a regional power marketing agency since its inception, as has been the Southwestern Power Administration, whose headquarters are in Tulsa. Plans are under way to propose to the Congress the establishment of a similar power marketing agency in the Southeast. Other Bureaus of the Department also have regional organizations or are considering their establishment.

A further move in this direction has been made by the establishment of a Missouri River Basin Field Committee, on which field representatives of all the Interior agencies directly concerned with the river basin program plan their work cooperatively. The Committee has prevented some delays and some conflicts. It reports to the Department's Water Resources Committee. In the Columbia River basin a Pacific Northwest Coordination Committee is pulling together the programs of the Interior agencies in that area. The Department is in the process of evaluating the various regional administrative concepts to determine which of them is best suited to the problems facing it.

Emergency Public Investment

The investment in our national plant is usually spread out thinly over the years. This is particularly true of the investment that does not pay for itself directly, but adds to the national wealth, and pays for itself gradually. The Department was asked by the Council of Economic Advisers, which was set up under Public Law 304, how much desirable and needed public investment could be hurried up, and how much money it would cost to get a very large public investment through the study, blueprint and design stage.

The Department's reply to the Council indicated that over any 3-year period of national emergency about 4.2 billion dollars could be spent on useful investment in public plant. The cost of rushing studies and

designs to completion over a 12-month period preparatory to any such emergency would average 4.3 percent of the total cost, or about 190 million dollars. The 3-year investment would include large amounts that would be wholly repayable, with interest, such as power, \$208,400,000, larger amounts in multiple-purpose projects that might be as much as three-quarters repayable, \$2,635,200,000, and other amounts that would produce a less direct return through taxes or fees, \$1,356,000,000.

The resource problems and programs outlined here must be met by considered action on the part both of the Congress and the administration. The solution of those problems, and the establishment of a sound and profitable resource base for the Nation, affect the economic life of all its citizens. The individual bureaus and agencies work together on the common problems. The account of their activities makes up part II of this annual report.

PART II

ANNUAL REPORTS OF BUREAUS AND
OFFICES OF THE DEPARTMENT
OF THE INTERIOR

The Bureau of Reclamation

MICHAEL W. STRAUS, *Commissioner*



WITH the cessation of hostilities in the fall of 1945, the Bureau of Reclamation immediately revised its budget request and in turn it received appropriations by the Congress of approximately 90 million dollars to resume a normal construction program. The Bureau's program during the war years had been definitely curtailed and limited to those projects which were believed by the WPB to be of assistance to the war food program and to such projects as would produce quickly large blocks of electrical energy.

To facilitate the quick resumption of construction activities after war-time restrictions were lifted and to eliminate a considerable amount of time and effort in awarding construction contracts, the Secretary of the Interior delegated to the Commissioner of Reclamation authority to approve change orders and award contracts up to \$500,000 in lieu of his previous authorization of \$50,000. In turn the Commissioner delegated to the Chief Engineer, to the Director of Supply, and to the Regional Directors authority to award contracts and approve change orders up to \$50,000. These delegations of authority assisted in expediting the purchase of materials and equipment and the initiation of construction on the Bureau's multi-million-dollar program.

The resumption of construction work on the Bureau's projects will provide irrigation water for many million acres of arid lands and thereby provide homesteads with unlimited opportunities for the returning veterans and will immediately provide a large number of man-hours of work both for returning veterans and unemployed war workers in jobs extending to factories producing materials and equipment for construction.

The year 1946 marked the beginning of the most extensive production program that has been proposed for the Bureau of Reclamation in any one year since the enactment of the Federal reclamation law in 1902. The construction of dams, pumping plants, canals, siphons, water distribution systems, power plants and transmission lines are included in the well-balanced development of the natural resources of the 17 Western States planned to create in 5 years more than 45,000 family-size irrigated farms on about 4,000,000 acres of productive lands.

TABLE 1.—*Summary of contracts executed in fiscal year 1946*

Nature of contracts	Number of contracts	Amount ¹ involved
Cooperative investigations	17	\$227, 475. 00
Supplies	196	289, 419. 05
Material	676	8, 840, 311. 71
Equipment	593	3, 420, 978. 58
Miscellaneous services	495	793, 487. 22
Construction work	112	45, 179, 723. 78
Land purchases, including improvements	386	696, 821. 25
Land sales, including improvements	7	21, 317. 00
Leases to the United States	162	195, 976. 53
Leases from the United States	658	430, 128. 95
Compromise of damages	0	0
Rental of Government equipment	112	19, 126. 68
Rental of water	293	237, 847. 09
Sale of surplus electrical energy	35	329, 291. 12
Sale of water rights to towns	0	0
Sale of water rights under the Warren Act	10	106, 959. 90
Sale of water rights within projects	32	113, 714. 10
Adjustment and relief	3	10, 962. 52
Transfer of project operations	0	0
Miscellaneous	187	3, 055, 987. 64
Acquisition of rights-of-way	34	52, 600. 00
Acquisition of water rights	5	27, 000. 00
Interim water service	6	100. 85
Total	4, 019	64, 048, 628. 97

¹ Estimated, in part. Many of the contracts awarded in fiscal year 1946 will be executed in fiscal year 1947.

Missouri Basin Construction Starts

Construction work on the Missouri River Basin project was started to advance the comprehensive over-all program for the complete development of the land and water resources of the arid, semiarid and subhumid areas of this river basin which includes one-sixth of the land surface of continental United States.

During the year 52 irrigation and power projects were in operation. Much of the power output from these projects went to airplane, aluminum, chemical and other industries classified as essential to Allied victory. Approximately 5 million people, amounting to nearly one out of five persons in the West, were served through the Bureau's irrigation, power, and municipal water service made possible by 44 years of construction work on Bureau of Reclamation projects.

Water Conservation and Utilization Progress

Construction activities on eight Water Conservation and Utilization projects were continued or resumed during fiscal year 1946. The Post Falls Unit of the Rathdrum Prairie project, Idaho; the Intake project, Montana; the Newton project, Utah; and the Scofield project, Utah were completed during the year.

The Fallon Unit of the Buffalo Rapids project-second division, Montana; the Mirage Flats project, Nebraska; the Rapid Valley project, South Dakota; and the Dodson Unit, Milk River project, Montana.

Funds are available for continuation of construction of the Eden, Wyo., and the Mancos, Colo., projects, but work is dependent on repayment and related considerations. Work is continuing on the Balmorhea project, Texas.

Civilian public service crews, under the Selective Service Program, continued work on three Reclamation projects during part of the fiscal year and helped to relieve to some degree labor shortages, which existed at that time, in continuing construction and development work. Work by these crews was gradually reduced so that by the end of the year none of these camps was in operation.

Veteran Settlement and Land Development

During the past year, Bureau projects stepped out with tangible accomplishments in making new lands available for settlement to veterans. Public lands on a number of projects have been readied for openings during the fall of 1946, and new private land farms received first irrigation water during the current irrigation season.

The importance of the Reclamation settlement program was recognized by the Congress through increased appropriations in the First Deficiency Act that was passed at the beginning of the calendar year. The projects that will provide new farms for veterans were singled out by the Congress for exceptional increases in appropriations. The same action was taken by the Congress in the regular appropriation act that was passed in June. After extended testimony by Bureau representatives, the Appropriations Committee increased construction funds to provide settlement opportunities.

In keeping with the expanded settlement program, the Bureau is provided with increased facilities for the success of the new farmers. By Order 2195, Secretary Krug provided for increased participation by local communities in the selection of entrymen on public land. A program of land development and settler-assistance was approved by the Commissioner. This program includes testing and leveling the land, roughing in of irrigation facilities and the coordination of all available resources, both within the Bureau and those offered by other agencies. These and other measures bring the Bureau of Reclamation's settlement program to the fore throughout the United States as a practical, effective, and timely program for meeting the desires of qualified veterans to establish themselves on irrigated farms.

Public Land Openings

The cessation of hostilities early in the fiscal year brought a strong revival of interest in land settlement, particularly on the part of war veterans

seeking a new start in civilian life. The Washington office alone received more than 3,500 inquiries concerning settlement opportunities during the year, while many thousands more were received by region and project offices.

To meet this demand, the Bureau expedited preparations for the opening of all suitable public lands in 1946 and construction and development work to open other public lands as soon thereafter as possible. Enlarged authority and responsibility in the selection of settlers was delegated to local examining boards. Boards to operate under this order were named on the Tule Lake division of the Klamath project in Oregon and California, the Roza division of the Yakima project in Washington, and the Heart Mountain division of the Shoshone project in Wyoming.

At the close of the year, farm unit layouts were practically completed and drafts of public notices in preparation for land openings on the following projects during the first half of the 1947 fiscal year:

Project	Total irrigable farm	
	Acreage	Units
Klamath project, Tule Lake division	7,527	86
Yakima project, Roza division	1,722	28
Shoshone project, Heart Mountain division	7,720	83
Minidoka project, Gooding division	3,500	44
Owyhee project	150	3
Total	20,619	244

Crop Production

As new projects or divisions are completed and placed in operation this fact is reflected in annual summarizations of the irrigable acreage for which water is available, the acreages that were irrigated, and the crops produced. In 1945 the total irrigable area exceeded 5,000,000 acres for the first time. This figure includes all areas receiving supplemental and surplus project water under the provisions of the Warren Act, as well as special contractors. Gross crop values totaled \$435,184,395, or \$103.72 per acre, based on the total of 4,195,732 acres in cultivation. This gross value was accompanied by high operating costs, inadequate labor and other uncertain conditions that confronted the farmer and reduced his net profits. On the whole, however, the reclamation farmers enjoyed prosperity in 1945 and were able to pay their obligations to the United States. Aiding to meet the Nation-wide demand for more food, reclamation projects were responsible for the production of 11,814,337 tons of food and forage crops in 1945.

Major Land Development Programs

During the fiscal year 1946 two great reclamation developments were initiated—one in the Missouri Basin in accordance with the congressional

authorization of December 1944 and the other in the Columbia Basin in accordance with the 1943 act of Congress. Those projects will bring into production large new irrigation blocks and will create many thousand new farms for settlement by veterans. On each project a development staff has been established for the purpose of providing the necessary basic agricultural and economic information concerning soils, crops, markets, repayment ability, and related information, together with the needed demonstrations for practical adaptation of irrigation farming practices to the new areas. The Missouri Basin project development staff also has an important immediate job in the development of new repayment contracts needed before delivery of irrigation water.

War Relocation Authority Centers on Reclamation Projects

During the fiscal year arrangements were made for retransferring to the Bureau of Reclamation areas of public land in the Tule Lake division, Klamath project, California; Gooding division, Minidoka project, Idaho; and the Heart Mountain division, Shoshone project, Wyoming, which had been made available during the war period to the War Relocation Authority for use as relocation centers. Temporarily such lands previously farmed under the direction of the War Relocation Authority have been leased to individuals in order that the areas would not go out of production during 1946. At the expiration of these one-year leases the area will be subject to reclamation homestead entry. Arrangements were being made under an amendment to the Interior Department Appropriation Act for 1947, for the transfer of real and personal property of these three War Relocation centers to the Bureau of Reclamation.

Operation and Maintenance Objectives

Irrigation water was made available in the 1946 irrigation season for the first time to nine projects on which construction had been carried forward during the war years as a part of the national effort to increase production of much needed food supplies. Approximately 43,500 additional acres will be irrigated in 1946 as a result of Bureau activities on these projects, which are the Altus, Deschutes, Intake, Kendrick, Mirage Flats, Newton, Scofield, Rathdrum-Prairie, and Tucumcari. In addition, on the Roza division of the Yakima project approximately 8,500 acres of land are being irrigated in 1946 for the first time.

Commencement of Construction Charge Payments

During the fiscal year public notices were issued announcing the commencement of construction charge payments in 1946 for two completed projects (Owyhee and Vale) and a portion of the irrigable land in the Roza division of the Yakima project. A total of 143,806 irrigable acres come under these notices, and the aggregate initial annual assessments will amount to \$325,296.

Amendatory and New Repayment Contracts

The accelerated postwar construction program now under way intensifies the Bureau's work on both new and amendatory repayment contracts. Building upon the experience of the past, a new approach is being taken in negotiating repayment contracts. Added emphasis is being given to the requirement of reimbursability of funds expended for irrigation development traditionally established by statute and policy. In addition, reimbursability is taking on new meaning with the increasing development of multiple-purpose projects embracing many features other than irrigation, such as hydroelectric power, flood control, navigation, fish and wildlife, protection and recreational activities. Problems related to land development are concerned with the reimbursability of those funds allocated to irrigation under which water users undertake to repay the Federal Treasury.

Determinations of the ability of water users to meet the reimbursable costs are an important consideration. The present program in this respect is designed to have a vital influence in the successful consummation of repayment contracts. Economic surveys, land classification, and farm management programs are included. The latter give special emphasis to the beneficial use of irrigation water to assure maximum crop production and permanent beneficial land use practices. Guidance for settlers is provided by the Bureau and cooperating Federal and State agencies.

Time is necessary before these activities can be made to function efficiently. Over a period of years they will have an important role in influencing the entire repayment program of the Bureau and should have far-reaching and beneficial results.

Deferment of construction installments was granted under existing law in the case of three projects during the year. These deferments, totaling \$67,884.50, for the Milk River project, Montana; Westland irrigation district, Oregon; and the Northport irrigation district, North Platte project, Nebraska, were granted in view of peculiar difficulties affecting the repayment ability of the water users.

On October 18, 1945, the Secretary of the Interior executed the first of the Central Valley project water contracts. During the following months negotiations with approximately 12 additional irrigation districts have been prosecuted with a view to making available the full Friant-Kern supply throughout the San Joaquin Valley. The general form of contract utilized in these negotiations is for water service over a 40-year period at a rate that will not exceed a maximum of about \$3.50 per acre foot. That type of contract is made necessary by the character of the project, involving among other things extensive water exchanges and other physical features that preclude the standard repayment arrangements. However, the excess land limitations and other requirements of law are fully incorporated

in the Central Valley contract form. Where needed, separate 40-year contracts are to be provided to cover distribution systems.

Land Ownership Survey

The extent of excess land holdings on the Federal reclamation projects was made the subject of an intensive survey and study, initiated because of the great interest being shown in the matter and the misunderstanding in recent years both as to the policies which Congress has laid down with respect to acreage limitation on the lands served by reclamation projects and as to the actual administration of these policies in the settlement and development of reclamation projects.

The survey showed that on projects now receiving water, the farms are preponderantly family-size farms. Ninety-seven percent of these farms containing 70 percent of the total irrigable acreage, are 160 acres or less in size, and 84 percent of the acreage is in farms not exceeding 320 acres. Only eight-tenths of 1 percent of the ownerships on projects receiving water in 1946 contain excess land which appears to be in violation of acreage limitations under Reclamation law. These ownerships contain only 3.8 percent of the entire irrigable area surveyed on the projects.

Canal Lining Program

During the fiscal year a program of research and testing of lower-cost canal linings was undertaken jointly by the Branches of Design and Construction, Operation and Maintenance, and the Regional Directors, for use in connection with the large construction program now under way and the needed rehabilitation of operating projects. The program will include an investigation of all types of canal linings now in existence, installation of measuring devices, and field studies to obtain accurate data on seepage losses.

Rehabilitation of Operating Irrigation Projects

The war years and the economic depression were periods when the irrigation facilities of operating projects received little attention. Scarcity of labor, materials, and supplies made it almost impossible for the water users to maintain the irrigation works in first-class operating condition. During the latter part of calendar year 1945, preliminary survey was made by the Bureau which revealed the possible need for extensive expenditures to repair, replace and restore various features on these operating projects.

During the first part of fiscal year 1947, it is expected to complete the detailed survey of each operating project which was completed and placed in operation prior to January 1, 1942. The results of the survey will determine the amount of rehabilitation work needed to restore the dams, canals, laterals, structures, and other complementary works.

TABLE 2.—Settlement and economic data, 1945

REGULAR PROJECTS

State	Project	Irrigated farms		Towns on or tributary to the project		Number of schools	Number of churches	Banks			Special Warren Act contractors	
		Number	Population	Number	Population			Number	Deposits	Number of depositors	Irrigated farms	Population
Arizona	Salt River	13,087	41,800	9	191,300	98	165	8	\$170,973,926	95,000	951	5,619
	Gila (Mesa division)	12	60	0	0	0	0	0	(?)	0		
Arizona-California	Yuma	1,741	2,877	5	14,390	14	35	3	(?)	(?)		
California	Oriand	667	1,952	1	1,600	5	12	1	4,200,000	3,309		
Colorado	Grand Valley 3	320	1,427	6	25,700	17	40	3	21,207,868	14,000	807	1,830
	Uncompagre	1,885	4,863	3	8,700	28	35	4	12,692,863	7,200	172	288
	Boise	4,236	15,250	16	55,895	118	131	6	216,121,865	(?)	4,764	19,516
Idaho	Mimidoka	3,598	11,161	10	13,495	32	73	6	(?)	(?)	9,708	44,065
	Bitter Root	328	1,061	5	4,532	15	13	4	7,457,264	5,290		
Montana	Frenchtown	43	1,185	1	100	1	1	0		0		
	Hundey	647	1,258	5	1,391	7	6	1	554,705	563		
	San River	722	2,274	12	11,778	29	38	7	18,820,313	10,499		
Montana-North Dakota	Lower Yellowstone	1,014	2,554	5	11,600	10	15	1	(?)	(?)		
Nebraska-Wyoming	North Platte	2,613	2,210	7	4,620	17	22	3	28,093,853	4,392		
Nevada	Norland	2,805	2,584	10	28,230	72	72	11	7,408,555	(?)	1,099	5,989
New Mexico	Cerritos	457	2,100	4	3,500	14	12	2	3,806,000	2,974		
New Mexico-Texas	Rio Grande	6,498	33,080	40	155,998	84	163	2	9,100,000	8,000	181	1,810
	Umatilla (east and west divisions)	400	1,260	15	8,227	7	14	1	147,220,808	2,914	37	71
Oregon	Vale	518	1,847	4	1,300	8	14	1	3,610,000	2,000		
Oregon-California	Klamath	991	2,938	5	33,863	30	35	3	(?)	(?)	560	1,680
Oregon-Idaho	Owyhee	1,564	7,160	8	19,850	28	25	3	8,038,529	6,006	235	705
South Dakota	Belle Fourche	1,591	1,616	5	3,788	25	23	3	11,186,414	14,517		
Utah	Strawberry Valley	1,961	6,500	6	15,242	22	21	2	7,480,332	4,300		
	Okanogan	3,393	1,074	3	5,000	8	8	2	28,037,094	19,192	4,500	17,162
Washington	Yakima	5,473	20,237	24	69,221	51	91	9	2,966,055	2,800	2	9
	Riverton	1,330	3,165	3	3,165	4	19	1	3,689,609	2,691		
Wyoming	Shoshone	1,028	1,917	6	6,765	3	15	1				
	Total	52,848	180,413	221	695,672	763	1,110	101	720,576,651	268,410	23,106	98,744

SUPPLEMENTAL STORAGE PROJECTS

California.....	4,511	28,000	8	42,000	63	26	7	(²)	(²)	
Colorado.....	88	352	1	300	2	2	0	0	0	
Idaho.....	238	745	5	1,007	20	12	1	\$542,099	500	
Nevada.....	1,198	4,840	14	9,990	23	33	4	8,236,462	8,634	
Oregon.....	138	204	1	1,200	3	4	1	(²)	(²)	
Utah.....	1,270	2,700	2	32,000	21	21	3	33,000,000	22,500	
	40	146	1	8	4	0	0	0	0	
	118	925	8	2,500	8	4	1	510,000	(²)	
	755	2,175	6	15,400	23	32	4	6,600,000	5,700	
	160	491	1	563	2	2	0	0	0	
	98	201	0	0	0	0	0	0	0	
	579	2,895	3	2,900	5	6	0	0	0	
	654	3,400	11	4,500	9	17	1	2,292,915	3,439	
	1,100	4,300	8	80,000	34	60	6	40,000,000	36,000	
	1,200	3,000	7	58,425	24	47	4	22,378,074	20,420	
	223	687	2	2,792	5	4	1	1,715,000	(²)	
	3,000	15,000	21	27,000	31	26	8	50,000,000	40,000	
Total.....	15,485	70,071	99	281,585	277	296	41	105,274,540	137,193	

WATER CONSERVATION AND UTILIZATION PROJECTS

Montana.....	131	350	2	1,300	{	14	3	\$6,400,000	4,800	
North Dakota.....	52	156			4	0	1	2,263,795	1,150	
	40	120								
Total.....	223	625	2	1,300	10	23	4	8,663,795	5,950	
Grand total.....	68,556	251,110	322	978,557	1,050	1,429	146	804,514,986	411,553	98,744

¹ Farms furnished partial or whole water supply under Warren Act or other special contracts.

² Data not reported.

³ Gravity division only; does not include Orchard Mesa irrigation district.

TABLE 3.—Cumulative crop values, 1906-45

Year	Federal irrigation projects ¹				Warren Act lands and special contractors				Entire area			
	Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value		Irrigated acreage	Net area in cultivation	Total crop value	
			For year	Cumulative total			For year	Cumulative total			For year	Cumulative total
1906	22,300	2,20,100	\$244,900	\$5,005,300	2,501,103	2,481,610	\$35,000,000	—	22,300	2,20,100	\$244,900	\$5,005,300
1907	187,628	2,160,000	4,763,888	12,441,248	910,313	890,613	2,268,468	860,368,468	187,628	2,160,000	4,763,888	12,441,248
1908	289,549	2,200,500	7,635,888	27,501,248	981,940	950,890	47,288,750	1,47,208,218	289,549	2,200,500	7,635,888	27,501,248
1909	410,628	2,369,500	12,920,639	57,502,560	1,001,250	998,550	47,288,750	1,92,438,848	410,628	2,369,500	12,920,639	57,502,560
1910	471,423	2,413,000	17,603,639	77,502,560	1,051,890	993,040	37,557,890	2,30,292,638	471,423	2,413,000	17,603,639	77,502,560
1911	502,311	2,470,100	13,088,441	90,600,125	1,051,890	993,040	43,237,470	2,73,530,108	502,311	2,470,100	13,088,441	90,600,125
1912	614,477	2,540,000	15,676,409	106,276,534	1,019,170	981,250	53,657,850	3,27,187,958	614,477	2,540,000	15,676,409	106,276,534
1913	694,422	2,637,227	18,473,517	124,750,051	1,019,170	981,250	53,657,850	3,80,845,808	694,422	2,637,227	18,473,517	124,750,051
1914	801,271	2,703,524	21,143,452	145,893,503	1,072,486	1,072,486	61,180,010	4,42,025,818	801,271	2,703,524	21,143,452	145,893,503
1915	822,821	2,780,035	22,815,972	168,709,475	1,145,115	1,145,115	69,405,290	5,11,431,108	822,821	2,780,035	22,815,972	168,709,475
1916	927,821	2,858,291	24,692,313	193,401,788	1,234,230	1,234,230	72,790,400	5,84,221,508	927,821	2,858,291	24,692,313	193,401,788
1917	1,026,668	2,940,784	26,821,308	220,223,096	1,324,230	1,324,230	72,790,400	6,57,011,908	1,026,668	2,940,784	26,821,308	220,223,096
1918	1,119,266	3,021,138	28,674,137	248,897,233	1,386,046	1,386,046	72,790,400	7,29,802,308	1,119,266	3,021,138	28,674,137	248,897,233
1919	1,151,266	3,103,403	30,821,308	279,718,541	1,445,115	1,445,115	72,790,400	8,02,592,708	1,151,266	3,103,403	30,821,308	279,718,541
1920	1,227,560	3,185,620	32,674,137	312,392,678	1,498,046	1,498,046	72,790,400	8,75,383,108	1,227,560	3,185,620	32,674,137	312,392,678
1921	1,267,560	3,267,880	34,521,308	346,913,986	1,551,890	1,551,890	72,790,400	9,48,173,508	1,267,560	3,267,880	34,521,308	346,913,986
1922	1,292,130	3,349,010	36,368,409	383,282,395	1,605,890	1,605,890	72,790,400	10,20,963,908	1,292,130	3,349,010	36,368,409	383,282,395
1923	1,317,700	3,430,710	38,215,510	421,497,905	1,659,890	1,659,890	72,790,400	10,93,754,308	1,317,700	3,430,710	38,215,510	421,497,905
1924	1,342,700	3,512,410	40,062,611	461,560,516	1,713,890	1,713,890	72,790,400	11,66,544,708	1,342,700	3,512,410	40,062,611	461,560,516
1925	1,367,700	3,594,110	41,909,712	503,470,228	1,767,890	1,767,890	72,790,400	12,39,335,108	1,367,700	3,594,110	41,909,712	503,470,228
1926	1,392,700	3,675,810	43,756,813	547,227,041	1,821,890	1,821,890	72,790,400	13,12,125,508	1,392,700	3,675,810	43,756,813	547,227,041
1927	1,417,700	3,757,510	45,603,914	591,830,955	1,875,890	1,875,890	72,790,400	13,84,915,908	1,417,700	3,757,510	45,603,914	591,830,955
1928	1,442,700	3,839,210	47,451,015	639,281,970	1,929,890	1,929,890	72,790,400	14,57,706,308	1,442,700	3,839,210	47,451,015	639,281,970
1929	1,467,700	3,920,910	49,298,116	688,580,086	1,983,890	1,983,890	72,790,400	15,30,496,708	1,467,700	3,920,910	49,298,116	688,580,086
1930	1,492,700	4,002,610	51,145,217	739,725,303	2,037,890	2,037,890	72,790,400	16,03,287,108	1,492,700	4,002,610	51,145,217	739,725,303
1931	1,517,700	4,084,310	52,992,318	792,717,621	2,091,890	2,091,890	72,790,400	16,76,077,508	1,517,700	4,084,310	52,992,318	792,717,621
1932	1,542,700	4,166,010	54,839,419	847,557,040	2,145,890	2,145,890	72,790,400	17,48,867,908	1,542,700	4,166,010	54,839,419	847,557,040
1933	1,567,700	4,247,710	56,686,520	904,243,560	2,199,890	2,199,890	72,790,400	18,21,658,308	1,567,700	4,247,710	56,686,520	904,243,560
1934	1,592,700	4,329,410	58,533,621	962,777,181	2,253,890	2,253,890	72,790,400	18,94,448,708	1,592,700	4,329,410	58,533,621	962,777,181
1935	1,617,700	4,411,110	60,380,722	1,023,157,903	2,307,890	2,307,890	72,790,400	19,67,239,108	1,617,700	4,411,110	60,380,722	1,023,157,903
1936	1,642,700	4,492,810	62,227,823	1,085,385,726	2,361,890	2,361,890	72,790,400	20,40,029,508	1,642,700	4,492,810	62,227,823	1,085,385,726
1937	1,667,700	4,574,510	64,074,924	1,148,460,650	2,415,890	2,415,890	72,790,400	21,12,819,908	1,667,700	4,574,510	64,074,924	1,148,460,650
1938	1,692,700	4,656,210	65,922,025	1,214,382,675	2,469,890	2,469,890	72,790,400	21,85,610,308	1,692,700	4,656,210	65,922,025	1,214,382,675
1939	1,717,700	4,737,910	67,769,126	1,282,151,801	2,523,890	2,523,890	72,790,400	22,58,400,708	1,717,700	4,737,910	67,769,126	1,282,151,801
1940	1,742,700	4,819,610	69,616,227	1,351,768,028	2,577,890	2,577,890	72,790,400	23,31,191,108	1,742,700	4,819,610	69,616,227	1,351,768,028
1941	1,767,700	4,901,310	71,463,328	1,423,231,356	2,631,890	2,631,890	72,790,400	24,03,981,508	1,767,700	4,901,310	71,463,328	1,423,231,356
1942	1,792,700	4,983,010	73,310,429	1,496,541,785	2,685,890	2,685,890	72,790,400	24,76,771,908	1,792,700	4,983,010	73,310,429	1,496,541,785
1943	1,817,700	5,064,710	75,157,530	1,571,699,315	2,739,890	2,739,890	72,790,400	25,49,562,308	1,817,700	5,064,710	75,157,530	1,571,699,315
1944	1,842,700	5,146,410	77,004,631	1,648,703,946	2,793,890	2,793,890	72,790,400	26,22,352,708	1,842,700	5,146,410	77,004,631	1,648,703,946
1945	1,867,700	5,228,110	78,851,732	1,727,555,678	2,847,890	2,847,890	72,790,400	26,95,143,108	1,867,700	5,228,110	78,851,732	1,727,555,678
1946	1,892,700	5,309,810	80,698,833	1,808,254,511	2,901,890	2,901,890	72,790,400	27,67,933,508	1,892,700	5,309,810	80,698,833	1,808,254,511
1947	1,917,700	5,391,510	82,545,934	1,891,800,445	2,955,890	2,955,890	72,790,400	28,40,723,908	1,917,700	5,391,510	82,545,934	1,891,800,445
1948	1,942,700	5,473,210	84,393,035	1,976,193,480	3,009,890	3,009,890	72,790,400	29,13,514,308	1,942,700	5,473,210	84,393,035	1,976,193,480
1949	1,967,700	5,554,910	86,240,136	2,062,433,616	3,063,890	3,063,890	72,790,400	29,86,304,708	1,967,700	5,554,910	86,240,136	2,062,433,616
1950	1,992,700	5,636,610	88,087,237	2,150,520,853	3,117,890	3,117,890	72,790,400	30,59,095,108	1,992,700	5,636,610	88,087,237	2,150,520,853
1951	2,017,700	5,718,310	89,934,338	2,240,455,191	3,171,890	3,171,890	72,790,400	31,31,885,508	2,017,700	5,718,310	89,934,338	2,240,455,191
1952	2,042,700	5,800,010	91,781,439	2,332,236,630	3,225,890	3,225,890	72,790,400	32,04,675,908	2,042,700	5,800,010	91,781,439	2,332,236,630
1953	2,067,700	5,881,710	93,628,540	2,425,865,170	3,279,890	3,279,890	72,790,400	32,77,466,308	2,067,700	5,881,710	93,628,540	2,425,865,170
1954	2,092,700	5,963,410	95,475,641	2,521,340,811	3,333,890	3,333,890	72,790,400	33,50,256,708	2,092,700	5,963,410	95,475,641	2,521,340,811
1955	2,117,700	6,045,110	97,322,742	2,618,663,553	3,387,890	3,387,890	72,790,400	34,23,047,108	2,117,700	6,045,110	97,322,742	2,618,663,553
1956	2,142,700	6,126,810	99,169,843	2,717,833,396	3,441,890	3,441,890	72,790,400	34,95,837,508	2,142,700	6,126,810	99,169,843	2,717,833,396
1957	2,167,700	6,208,510	101,016,944	2,818,850,340	3,495,890	3,495,890	72,790,400	35,68,627,908	2,167,700	6,208,510	101,016,944	2,818,850,340
1958	2,192,700	6,290,210	102,864,045	2,921,714,385	3,549,890	3,549,890	72,790,400	36,41,418,308	2,192,700	6,290,210	102,864,045	2,921,714,385
1959	2,217,700	6,371,910	104,711,146	3,026,425,531	3,603,890	3,603,890	72,790,400	37,14,208,708	2,217,700	6,371,910	104,711,146	3,026,425,531
1960	2,242,700	6,453,610	106,558,247	3,132,983,778	3,657,890	3,657,890	72,790,400	37,86,999,108	2,242,700	6,453,610	106,558,247	3,132,983,778
1961	2,267,700	6,535,310	108,405,348	3,241,389,126	3,711,890	3,711,890	72,790,400	38,59,789,508	2,267,700	6,535,310	108,405,348	3,241,389,126
1962	2,292,700	6,617,010	110,252,449	3,351,641,575	3,765,890	3,765,890	72,790,400	39,32,579,908	2,292,700	6,617,010	110,252,449	3,351,641,575
1963	2,317,700	6,698,710	112,099,550	3,463,741,125	3,819,890	3,819,890	72,790,400	40,05,370,308	2,317,700	6,698,710	112,099,550	3,463,741,125
1964	2,342,700	6,780,410	113,946,651	3,577,687,776	3,873,890	3,873,890	72,790,400	40,78,160,708	2,342,700	6,780,410	113,946,651	3,577,687,776
1965	2,367,700	6,862,110	115,793,752	3,693,481,528	3,927,890	3,927,890	72,790,400	41,50,951,108	2,367,700	6,862,110	115,793,752	3,693,481,528
1966	2,392,700	6,943,810	117,640,853	3,812,122,381	3,981,890	3,981,890	72,790,400	42,23,741,5				

1940-----	2, 152, 808	2, 188, 927	80, 008, 106	1, 717, 038, 809	1, 238, 282	1, 177, 103	37, 090, 481	1, 058, 737, 576	3, 391, 070	3, 316, 030	117, 788, 677	2, 775, 776, 445
1941-----	2, 199, 179	2, 178, 288	110, 399, 806	1, 827, 438, 075	1, 140, 204	1, 202, 172	49, 380, 191	1, 108, 225, 767	3, 339, 883	3, 380, 460	159, 885, 997	2, 935, 662, 442
1942-----	2, 277, 955	2, 259, 653	155, 619, 716	1, 985, 088, 361	1, 602, 907	1, 362, 046	176, 428, 800	1, 224, 655, 567	3, 880, 862	3, 821, 699	273, 048, 516	3, 207, 710, 958
1943-----	2, 422, 288	2, 398, 922	218, 064, 208	2, 201, 122, 599	1, 633, 041	1, 615, 424	170, 406, 761	1, 393, 555, 228	4, 055, 320	4, 014, 348	388, 670, 969	3, 596, 381, 927
1944-----	2, 468, 842	2, 476, 280	224, 083, 280	2, 425, 805, 879	1, 694, 881	1, 684, 069	186, 543, 084	1, 581, 802, 412	4, 163, 703	4, 130, 349	411, 226, 364	4, 007, 698, 291
1945-----	2, 416, 961	2, 464, 672	232, 545, 321	2, 668, 351, 200	1, 745, 627	1, 731, 060	202, 636, 074	1, 784, 341, 486	4, 162, 588	4, 106, 732	435, 184, 365	4, 442, 792, 686

¹ Includes projects constructed by the United States and those for which supplemental water is furnished from storage works built by the United States.

² Estimated.

TABLE 4.—*Projects in operation—Irrigation and crop value data for the calendar year 1945—Continued*

State, project, and sub-division	Projects entirely constructed by the Bureau						Projects furnished supplemental storage water from works constructed by the Bureau				Special and Warren Act contractors receiving water from Bureau constructed works					
	Irrigable area ¹	Irrigated area	Land subject to construction charges		Temporarily suspended lands ²		Irrigable area ¹	Irrigated area	Net area in cultivation	Crop values		Irrigable area	Irrigated area	Net area in cultivation	Crop values	
			Net area in cultivation	Crop values	Net area in cultivation	Total crop values				Total	Per acre				Total	Per acre
MONTANA	Acres	Acres	Acres				Acres	Acres	Acres			Acres	Acres	Acres		
Bitter Root ¹	16,553	16,392	16,553	\$686,955	\$41.50	0	0									
Buffalo Rapids:																
First division.....	13,109	12,630	12,787	579,906	45.35	0	0									
Second division.....	8,100	4,886	4,886	60,979	12.48	0	0									
Total — Buffalo Rapids project ¹	21,209	17,516	17,673	640,885	36.28	0	0									
Frenchtown.....	4,978	2,195	2,807	131,740	46.93	0	0									
Huntley.....	29,580	24,195	17,012	1,026,951	60.01	7,426	\$190,219									
Milk River:																
Mata division.....	58,652	23,999	14,658	645,927	44.07	9,742	123,053									
Glasgow division.....	21,997	6,745	8,184	217,222	33.76	205	4,573									
Chinook division.....	43,484	26,801	26,792	1,376,982	51.17	0	0									
Pump lands.....	3,848	3,848	3,847	317,192	82.45	0	0									
Total—Milk River project.....	125,981	60,393	53,481	2,651,323	49.58	9,947	127,626									
Sun River:																
Fort Shaw division.....	13,902	7,632	8,301	183,934	22.16	188	3,396									
Greenfields division.....	82,963	68,457	72,184	1,560,487	21.62	0	0									
Total—Sun River project.....	96,865	76,139	80,485	1,744,421	21.67	188	3,396									

MONTANA-NORTH DAKOTA													
Lower Yellowstone:													
District No. 1, Montana.....	36,977	32,304	31,496	1,897,818	60.26	808	32,509						
District No. 2, North Dakota.....	19,689	15,787	15,419	782,502	50.75	368	16,922						
Total—Lower Yellowstone project.....	56,666	48,091	46,915	2,680,320	57.13	1,176	49,431						
NEBRASKA-WYOMING													
North Platte:													
Pawinder irrigation district.....	112,943	86,043	74,650	4,336,681	58.08	11,393	208,840						
Gering & Fort Laramie irrigation dam.....	54,845	51,994	50,979	3,134,029	61.96	1,415	22,647						
Goshon irrigation district, Wyoming.....	52,496	45,698	42,708	2,556,413	59.86	2,990	21,740						
Northport irrigation district.....	16,170	9,608	8,564	261,388	30.52	1,044	11,014						
Total—North Platte project.....	236,444	193,343	176,501	10,287,511	58.29	16,842	264,241					108,715	100,414
NEVADA													
Humboldt.....	67,469	57,662	57,662	2,290,767	39.71	1,190	11,917	37,046	17,928	17,928	1,034,666	\$57.71	
Truckee River storage.....								29,376	(No report received)				
NEW MEXICO													
Carlsbad.....	25,055	20,715	20,715	1,539,967	74.34	0	0						
NEW MEXICO-TEXAS													
Rio Grande:													
Elephant Butte Irrigation District, New Mexico.....	88,000	88,714	85,256	11,692,644	137.15	3,754	309,580						
El Paso County water improvement district No. 1, Texas.....	67,000	65,747	63,125	10,142,062	160.67	2,727	245,688						
Total—Rio Grande project.....	155,000	154,461	148,381	21,834,706	147.15	6,481	555,268					17,793	15,220
													15,220
													2,075,600
													135.14

See footnotes at end of table, p. 75.

OREGON-IDAHO												
Owyhee:												
Advancement irriga-	701	625	640	46, 145	72. 10	0	0					
tion district.....												
Bench irrigation dis-	2, 310	2, 241	2, 241	380, 338	169. 72	0	0					
trict.....												
Crystal irrigation dis-	1, 204	1, 166	1, 166	285, 480	244. 84	0	0					
trict.....												
Owyhee irrigation	55, 375	49, 012	49, 725	4, 505, 841	90. 62	0	0					
district.....												
Payette-Oregon Slope	4, 601	4, 197	4, 202	875, 523	208. 36	0	0					
irrigation district.....												
Ontario-Nyssa irriga-	5, 920	5, 592	5, 622	662, 449	117. 83	0	0					
tion district.....												
Gen irrigation dis-	30, 213	28, 826	28, 733	2, 571, 491	89. 50	776	44, 054					
trict, Idaho.....												
Slide irrigation dis-	1, 092	1, 067	1, 068	130, 075	121. 79	0	0					
trict.....												
Total—Owyhee	101, 476	92, 726	93, 397	9, 457, 342	101. 26	776	44, 054			13, 800	13, 130	13, 130
project.....												123. 17
SOUTH DAKOTA												
Belle Fourche.....	72, 431	42, 435	51, 340	1, 408, 945	27. 46	565	0					
UTAH												
Lyrum.....												
Moon Lake.....												
Ogden River.....												
Provo River—Deer Creek												
division.....								6, 201	5, 717	5, 779	289, 707	50. 14
								72, 008	56, 255	56, 255	779, 372	13. 85
								21, 713	15, 458	15, 458	1, 292, 227	83. 60
								38, 027	27, 163	27, 899	4, 276, 065	153. 27
Sanpete:												
Epfraim division.....								6, 700	5, 458	5, 704	165, 788	29. 07
Spring City division.....								6, 017	4, 382	4, 532	115, 176	25. 41
Total—Sanpete												
project.....								12, 717	9, 840	10, 236	280, 964	27. 45
Strawberry Valley:												
Ughline division.....	18, 404	16, 203	16, 953	911, 681	53. 78	0	0					
Spanish Fork divi-	13, 725	12, 789	13, 000	871, 331	66. 72	0	0					
sion.....												
Springville-Mapleton	8, 867	8, 120	8, 368	835, 711	99. 87	0	0					
division.....												
Total—Strawberry	40, 906	37, 172	38, 381	2, 618, 723	68. 23	0	0					
Valley project.....												
Weber River: Salt Lake												
Basin.....								91, 374	80, 478	90, 118	13, 797, 750	153. 11

See footnotes at end of table, p. 75.

TABLE 4.—*Project in operation—Irrigation and crop value data for the calendar year 1945—Continued*

[illegible]

Planning Horizons

Comprehensive investigations of irrigation and multiple-purpose projects in the major river basins of the West were rapidly advanced or completed during the fiscal year with regular and supplemental appropriations for planning investigations greater than ever previously available.

Although regular appropriations made before cessation of hostilities were small, supplemental appropriations were quickly made available by the Congress after the fall of Japan.

Comprehensive surveys of 25 major river basins and some 200 investigations of sub-basins and projects were in progress during the year. Six basin and project reports comprising Santa Barbara County, Calif.,¹ Lewistown Orchards, Idaho, Payette Unit of Mountain Home, Idaho,¹ Paonia, Colo., projects and Central Valley, Calif.,² and Colorado River Basin comprehensive reports, were completed. Hearings on authorization of construction and development of the Lewistown Orchards project were in progress before the Senate Committee on Irrigation and Reclamation at the end of the year.

Stepped-up progress on investigations of other basins and projects has enabled scheduling many of them for field completion during the next fiscal year.

Increased emphasis was given to the development of new techniques in studies of meteorology, hydrology, and in the investigations of sedimentation. Assistance was given to regional and project offices in making investigations of land classifications, land use, farm organization, industrial resources, benefits, costs, and other economic phases of project planning.

Basic information on the historical trends of farm commodity prices was assembled and conferences held with commodity specialists of the United States Department of Agriculture to develop the farm price outlook. These data and opinions are being used to determine the agricultural commodity price levels to be used in planning irrigation projects.

Some 35 reports covering flood control and river and harbor improvements submitted to the Secretary of the Interior by the Corps of Engineers of the War Department in accordance with the Flood Control Act of 1944 were reviewed and commented on during the year. The Branch of Project Planning and other offices in the Bureau and in the Department review such reports with particular attention to their relation to water supplies for irrigation, power, municipal purposes, and other multiple uses.

To bring about greater uniformity in practices among the Federal agencies concerned with development of water resources, personnel in the

¹ Some revisions of these reports may be required in the light of comments received from the Bureau of the Budget.

² This report requires further consideration, which it is not actively receiving, in the light of comments by the State of California and by the Secretary of War.

Branch of Project Planning represent the Bureau on the Federal Inter-Agency River Basin Committee's subcommittees on benefits and costs, correlation of hydrologic data, sedimentation, and on preparation of statement of differences between the Interior and War Department reports on the Central Valley of California.

In attempting to expand Planning activities in the field to a degree commensurate with the increase in investigation funds, considerable difficulty was encountered in obtaining sufficient qualified personnel and essential equipment, particularly transportation equipment. Although during the latter half of the fiscal year, release of men from the armed services alleviated the general situation appreciably and the equipment problem was being slowly solved, lack of housing for personnel continued to handicap the planning program. In the face of these difficulties, some of the funds appropriated for planning in fiscal year 1946 were carried over into fiscal year 1947.

Power for the West

A major element in the Bureau of Reclamation postwar plan for the development of the West is the program for the development of additional sources of electric power and the construction of the transmission lines required to bring such power to market. The inevitable result of this vast development program will be the creation of new communities, both agricultural and industrial. One of the major factors influencing the shaping of the social structure of such modern communities is low cost electric power. The utilization of the potential power made available through the harnessing of rivers by means of multiple-purpose projects is of necessity an integral part of the postwar program. Moreover, the sale of this power benefits the project areas in two important respects. First, it makes available in an impartial manner with preference to public agencies and municipalities low cost electric energy, without which the development of the project areas would be impeded. Secondly, the revenues from the sale of such power repays to the Federal treasury the major part of the cost of the project and thereby greatly assists the project in meeting the payout requirements set forth in the Reclamation law.

With the above factors in mind, the Bureau of Reclamation is developing its program to meet the power requirements with the most suitable and efficient power systems that are possible to obtain. The year ended June 30, 1946, found an auspicious start made in the actual construction of these power systems.

The power development proposed by the Bureau offers the solution to two basic problems facing the States of the West. It will provide adequate quantities of low cost power for the development of new industries in these States; industries which will utilize the heretofore untapped vast store of mineral resources as well as the related agricultural products in this section

of the country. Lack of sufficient electric power has been a principal handicap to earlier development. The program will also provide a stimulus to the agricultural development of these States by making low-cost power available for pumping water to irrigate thousands of acres of arid land. Already the exigencies of the war has resulted in developments along these lines and has created a market for additional electric power in those areas.

During the war the Bureau's power facilities were overloaded even though a spectacular expansion was made to meet the power requirements of the industries. Now, almost a year after the cessation of hostilities, this overloading continues and it is clear that several areas in the Western States which received large quantities of power for war work from Bureau power plants will require even more power for vastly expanded peacetime industrial developments stimulated by wartime developments and increased domestic usage resulting from the large population increases. The continued growth and development of certain western areas will be hampered seriously unless additional power is made available. In some cases this condition is aggravated by the approaching obsolescence of fuel-burning power plants or the expected depletion of low cost fuel resources. The logical solution to this problem is the utilization of falling water, a recurring resource, as the source of power. The Bureau and other agencies are making power studies of various areas where critical power shortages have already occurred or will occur if additional generating capacity is not provided. The results of these studies will indicate the power developments whose construction must be accelerated in order to meet the energy requirements of those areas.

In the period between VJ-day and the end of the fiscal year, the Bureau was faced with serious shortages of manpower and of materials of almost every item required for power plant construction. In spite of these difficulties, substantial progress was made on the construction program. Exceptional progress has been made on the engineering and design phases of the program and the Bureau has prepared the foundation for an accelerated program for the forthcoming years.

Included in the Bureau's power development program is a proposed system of transmission lines connecting load centers with sources of power. The Bureau's policy to market power in wholesale quantities at transmission line voltages, giving preference to public agencies such as municipalities and cooperative groups can only be achieved by the construction of a well-planned transmission network. In order to accomplish this, it is necessary that the Government build these transmission lines to assure that the power will be available to such organizations at load centers at the lowest cost possible. In addition, a well coordinated system for delivering power continuously as cheaply as possible makes it imperative that a unified development of the central stations and transmission line facilities take place.

A significant start on the program of transmission line construction has also been made within the last year. Construction has started on several of the principal lines which will become important links in future systems. These systems will be rounded out to completion to coordinate the installation of generating equipment and transmission and substation facilities to coincide with the demands for additional power.

Another aspect of the Bureau's transmission line program is the construction of additional line facilities to supplement existing lines that are heavily overloaded. Construction of these lines was curtailed during the war years, but the areas which they served sustained a tremendous load growth during this period. The additional transmission lines are required to provide an adequate power supply to these areas.

The Bureau's plants which range in size from two of the largest in the world at Boulder Dam and Grand Coulee to some relatively small plants located on various irrigation projects are all producing to capacity. This past year saw no let-up in their service to the West; they continue to play their vital role in the development of that area. It is significant to note that the over-all trend of development of the Western States has to a very large degree followed the trend of the Bureau's activities in those States.

The postwar power program is one of great magnitude and its orderly development is of necessity scheduled over a period of years. Feasibility requirements are probably the determining factors governing the scheduling of the individual units of the whole program. Specifically, the present installed capacity of 2,439,300 kilowatts will reach a total of 4,389,700 kilowatts when installations in existing plants are completed. This total will be approximately 7,000,000 kilowatts of installed capacity upon completion of projects now under construction or authorized for construction by the Bureau of Reclamation and including authorized plants of other agencies for which the Bureau of Reclamation has been given the responsibility of marketing the power.

The fact is that a start has been made on this power program; this past year saw it gain its initial momentum. The preliminary work is well done and the way is paved for even greater progress toward its final realization in the forthcoming years. In the last analysis this power program is dedicated to the achievement of better living in the great area it is to serve. That cannot be realized until the goal of providing an abundance of low cost electric power to the widely diversified industrial and agricultural areas of the West is reached.

Design and Construction

To meet the demands of the stepped-up schedule, design work during the second half of the fiscal year reached a volume exceeding by several times that of any prewar period. A total of 845 contracts amounting to

approximately \$107,000,000 were awarded during the fiscal year. During the same period, 1,520 invitations to bid were issued on construction work and materials and operating equipment, amounting to \$156,000,000.

At the end of the fiscal year, work on designs and specifications for authorized projects was in progress on 32 dams, 13 power plants, 52 pumping plants, and 43 major canal systems. In addition, preliminary designs and estimates were being prepared on engineering features for numerous other projects.

Construction was begun on such major works as Kortes Dam in Wyoming, first Bureau unit of the Missouri Basin project; the 160-mile Friant-Kern Canal on the Central Valley project in California; the vast irrigation system for the Columbia Basin project in Washington; and Davis Dam and power plant on the lower Colorado River. At the end of the fiscal year construction was in progress on 13 dams, 5 power plants, 19 pumping plants, and 185 miles of main canals.

The following dams were completed: Scofield and Newton Dams in Utah, Shadow Mountain Dam on the Colorado-Big Thompson project, and Box Butte Dam on the Mirage Flats project in Nebraska. Completed construction included one power plant, four pumping plants, 352 miles of transmission lines, and 87 miles of main canals, as well as the concrete lining of the 13-mile-long Alva B. Adams tunnel through the Continental Divide. First water on the Tucumcari project in New Mexico was delivered to landowners in November, quickly followed by first water delivery on the Altus project in Oklahoma, and on the Deschutes project in Oregon.

Effect of Reconversion

Construction materials and equipment shortages were reflected in the reluctance of some construction firms and manufacturers to bid on contracts involving the supply of materials. More bids than usual were rejected during the fiscal year as excessively high.

Uncertain labor supply and wages were also contributing factors to construction difficulties. However, the use of an escalator clause in many major contracts helped to alleviate the risk of labor uncertainties for construction contractors. This clause provides for increased payments to contractors in the event of approved increased wage rates. Labor supply was improved to a considerable degree in the latter part of the fiscal year by return of veterans to civilian work. Work stoppages of comparatively minor importance occurred on some projects.

With the active resumption of Reclamation peacetime construction, costs have shown substantial increases over those of the prewar period. Costs have fluctuated from a low point of 155 percent to a high point of about 200 percent of 1940 price levels. The following index ratios indicate relative increases over 1940 construction costs:

	1945	1946
Concrete dams.....	155	157
Earth dams.....	165	172
Tunnels.....	155	156
Canals.....	160	168
Laterals.....	163	171
Drains.....	170	175
Pumping plants.....	148	149
Power plants.....	130	149
Transmission lines (wood pole).....	142	139

Research

Increased research activities in the Denver laboratories were directed toward the development of new and more economical materials, more practicable design, and improved construction methods. A comprehensive program of research in canal linings was started toward the objectives of improving linings and lowering construction and operating costs. In addition, the laboratories are cooperating in a broad research program of weed control. The ultimate benefits of this program to combat noxious weeds may well extend beyond Bureau project boundaries.

A soils mechanics research laboratory and a bituminous materials laboratory have been added to research facilities during the year. Preliminary plans have been prepared for the construction of 10 outdoor laboratories to permit further and more extensive research in several fields.

Engineers and technicians of the Bureau have continued to devise new methods and equipment. Bureau employees reported 26 inventions during the fiscal year.

Summary of construction results June 30, 1902, to June 30, 1946

Reservoir capacity.....	acre-feet.....	67, 897, 248
Waste-water ditches.....	miles.....	3, 143
Tunnels:		
Number.....		355
Length.....	feet.....	566, 521
Storage dams:		
Masonry.....	cubic yards.....	28, 025, 444
Earth and rockfill.....	do.....	55, 221, 677
Total number.....		100
Diversion dams:		
Masonry.....	cubic yards.....	1, 008, 232
Earth and rockfill.....	do.....	3, 259, 671
Total number.....		68
Dikes and levees.....	cubic yards.....	13, 277, 667
Bridges:		
Number.....		13, 902
Length.....	feet.....	373, 098

Culverts:		
Number	-----	23,816
Length	-----feet	1,085,166
Pipe laid, length	-----do	12,937,155
Flumes:		
Number	-----	6,244
Length	-----feet	978,492
Canals:		
Miles	-----	15,325
Structures	-----number	219,670
Lined, length	-----miles	1,250
Power plants:		
Number	-----	33
Capacity	-----kilowatts	2,178,197
Output, full year 1946	-----kilowatt-hours	13,172,988,997
Pumping plants:		
Number	-----	335
Discharge capacity	-----cubic feet/sec	9,380
Year's pumpage	-----acre-feet	1,496,462
Operating transmission lines	-----miles	2,516
Excavation, all classes	-----cubic yards	625,574,739
Concrete	-----do	34,123,144
Cement	-----barrels	38,870,583

Regional Programs

The activities of the seven Bureau regional offices were greatly expanded. Coordination of activities in the major watersheds and supervision close to the field of operation has been accomplished through regionalization. A summary of important activities in each of the regions follows.

Region 1

Four major high lights featured the Bureau of Reclamation's activities in region 1, the Pacific Northwest. Water was delivered for the first time to two new projects; construction was initiated on the Nation's largest single irrigation system; reclamation farmers recorded the highest gross and per-acre crop values in history; and major strides were made in planning for a vast postwar construction program.

The Bureau's operating projects were increased by the addition of the 50,000-acre north unit of the Deschutes project in central Oregon and the 3,500-acre north unit (Post Falls) of the Rathdrum Prairie project in northern Idaho. Water was delivered to the Deschutes project on May 18, 1946, and to the Rathdrum Prairie project on June 26, 1946. The events were celebrated on both projects.

Crops produced on 13 Federal reclamation projects in region 1, which provide a full or partial supply of water to 1,792,102 acres under cultivation, were valued at \$189,921,654, highest on record. The return, which was \$11,800,335 more than the previous high reached in 1944, averaged \$105.98 per acre, another new peak.

With the Nation calling for utmost food production, reclamation farmers in the Pacific Northwest produced huge quantities of crops in 1945, including 49,000,000 bushels of potatoes (enough to provide a year's supply for approximately 23,000,000 people), 54,000,000 bushels of vegetables, 985,000,000 pounds of fruit, 1,307,969 tons of sugar beets, and 2,276,000 tons of hay and forage crops for beef and dairy herds. Equally high yields are expected during the 1946 irrigation season.

Columbia Basin construction starts.—Construction began on the largest single irrigation development ever undertaken in the United States—the million-acre Columbia Basin project. The first contract work on irrigation facilities, which when completed will cost an estimated \$355,344,000, started May 8, 1946. At the end of the fiscal year, contracts valued at \$12,608,826 had been let and bids opened for additional work that will cost \$2,335,651.

On July 1, excavation for the southerly 6½-mile section of the huge main canal was well under way, and companies holding awards for dams, siphons, tunnels, and for manufacturing equipment to serve the irrigation system, were preparing to start under their contracts. The Bureau's goal was to serve 6,000 acres near Pasco, at the southern tip of the project, in 1947 and 400,000 acres elsewhere in 1951.

Marked construction progress was also made at Anderson Ranch Dam of the Boise project, which when completed will be the highest earth-fill dam in the world. At the end of the fiscal year 7,300,000 of the 8,650,000 cubic yards of material of which the structure will be composed had been placed. The dam will provide supplemental water for 320,000 acres in the Boise Valley. The initial 80,000 acre-feet of storage was provided in the spring of 1946. The project's scheduled completion date is the winter of 1947-48.

Noteworthy also was the construction progress on the Deschutes project. Forty-four miles of the 65-mile long north unit (main) canal, together with laterals and sublaterals to serve 20,000 acres on the north unit during the 1946 irrigation season, were brought to completion. Primary work during the next fiscal year will include construction of the remaining 21 miles of main canal and laterals to serve 30,000 additional acres of land. Part of this new block is to be served in calendar year 1947, and the rest in 1948.

The Roza division of the Yakima project continued to make increasingly large contributions in war foods because of the rapid pace at which construction operations were carried forward. All work authorized under the war food program was brought to substantial completion. The distribution system for the last 5,000 acres of the 47,000-acre gravity unit was nearly complete at the year's end. Previously the last 10 miles of the 95-mile long main canal had been completed. Facilities to serve 25,000 additional acres by pumping from the main canal, on which construction was about to begin at the end of the year, will be substantially completed in calendar year 1947.

Construction was initiated in June 1946, on the Cascade Dam of the Boise project. It will serve 25,000 acres of new land (7,000 of which is

Government-owned and will be opened for homesteading) and also bring a supplemental water supply for 85,000 acres in the Emmett Valley.

On the Minidoka project, the Bureau planned early in the next fiscal year to begin the rehabilitation of the 70-mile long Milner-Gooding Canal and the building of laterals to serve approximately 4,500 of 18,000 acres of public land. A wasteway is to be constructed on the Owyhee project (Oregon-Idaho).

Settlement opportunities—All construction activities in region 1 were aimed at the prime Bureau objective of making settlement opportunities available for qualified veterans as quickly as possible. During the first half of fiscal year 1947, approximately 4,904 acres are scheduled to be opened to homestead entry. Approximately 3,500 acres will be served by the Milner-Gooding Canal of the Minidoka project, 1,254 acres are on the Roza division of the Yakima project, and 150 acres on the Owyhee project. With \$28,973,691 in regular appropriations made available by Congress for fiscal year 1947, facilities will be brought to near completion that will supply water for more than 100,000 acres, including 30,000 acres of public land.

Work on two projects in the preconstruction stages was advanced. Investigation work, consisting principally of core-drilling and materials exploration, was in progress at Palisades Dam site in southeastern Idaho. Palisades Dam will provide supplemental water for a large block of irrigated land, a full supply for some new land, produce a sizable block of power, and aid in the control of Snake River floods. Core-drilling and building of an access road was a major activity at Hungry Horse project in northwest Montana. Hungry Horse Dam is being designed to provide storage for irrigation, power development at the site, increasing the firm output of downstream plants (including Grand Coulee Dam) and for flood control and improvement of navigation.

Project investigations.—Project investigation of potential irrigation and multiple-purpose developments received great emphasis. Forty-four widely scattered projects were under study during the year. The largest undertaking was the comprehensive investigation of water resource utilization in the entire Columbia River Basin. At the year's end the 700-page report, drafted in 1945, had been completely revised and was in the process for reproduction.

The study outlines graphically the vast resource-development potentialities in the drainage basin. A total of 238 separate projects, many of them multiple-purpose in scope, are listed. These would provide a full supply of water for 3,840,000 acres of new land and a supplemental supply of 1,520,000 acres now suffering periodic shortages.

A huge new block of hydroelectric power would be produced, including 55.6 billion kilowatt-hours of firm energy, and 9.1 billion kilowatt-hours of secondary power. New installations at 63 additional hydroelectric plants

and in existing powerhouses totaling in excess of 10,500,000 kilowatts are forecast.

At 1940 price levels, the entire development program including the \$1,000,000,000 transmission system would cost \$3,500,000,000.

In addition to the comprehensive Columbia River report, two project investigations were completed: a 230,000-acre unit of the Mountain Home project, near Boise, Idaho; and the Lewiston Orchards project, near Lewiston, Idaho. Three reports were drafted and reviewed by agencies concerned, namely, the Palisades Reservoir project in southeastern Idaho, the Hayden Lake Unit in north Idaho, and the Yakima River channel surveys in south central Washington. A report on the Kennewick division of the Yakima project also was drafted. A basin-wide study of the Rogue River, part of the North Pacific Basin, was well advanced.

Atomic power.—In the field of power, the full scope of the great role played by the Grand Coulee Dam power plant in the prosecution of the war became known for the first time. One of the two factories producing atomic bombs was erected near Hanford, Wash., because of the abundance of power available at Grand Coulee Dam.

Including the Hanford plant, the Grand Coulee generators, together with those at Bonneville Dam, served directly manufacturing facilities with an investment of \$573,850,000. These plants represented two-thirds of the total investment in war plants in the area. A substantial proportion of other plants were dependent on Columbia River power but received it through one of the private utilities.

The war industries in the Northwest were awarded \$6,590,000,000 in war supply contracts. The wartime production of Pacific Northwest plants included 1,859,685,000 pounds of aluminum ingot, 370,698,000 pounds of aluminum sheet, and 23,858,000 pounds of magnesium ingot.

With the end of the war in August 1945, production of hydroelectric energy on four Bureau projects in region 1 dropped off considerably—from a gross output of 4,894,069,245 kilowatt-hours in fiscal year 1945 to 3,821,414,730 this year. Grand Coulee's plant produced 3,617,025,000 kilowatt-hours; Minidoka, 116,376,500; Boise, 62,253,900; and Yakima, 25,759,330.

Contracts were reinstated for three 108,000-kilowatt generators at Grand Coulee Dam, and bids were called for three additional 108,000-kilowatt units. When these are in operation the rated capacity of the plant will be 1,316,000 kilowatts, making it the largest in the world.

The first application for power from the proposed 40,500 kilowatt power plant at partially-completed Anderson Ranch Dam was received from the Prairie Power Cooperative, Inc., Fairfield, Idaho. It requests 100 to 300 kilowatts of energy.

Employment rises.—The increased activity in region 1 is attested to by employment totals. On July 1, 1945, some 1,773 persons were employed

by the Bureau as compared with 3,765 on July 1, 1946. The regional office staff grew from 79 to 205 during the same period.

The major personnel change in region 1 was the appointment of R. J. Newell as Regional Director. Frank A. Banks, formerly Director, asked to be allowed to confine his activities to the Columbia Basin project as supervising engineer. Appointed Assistant Regional Directors in April and June 1946 were J. Lyle Cunningham and Harold T. Nelson.

Columbia Basin Committee.—With the objective of coordinating the planning, construction, and administration of multiple-purpose development programs of the Columbia River drainage basin and the coastal areas in the States of Washington and Oregon which drain into the Pacific Ocean, a Columbia Basin Inter-Agency Committee was organized in April 1946.

On the Committee are represented the Departments of Interior and Agriculture, the War Department, the Bonneville Power Administration, and the Federal Power Commission. Each of the seven basin States are entitled to a representative who serves in an advisory capacity. They constitute a link between the people of the basin and Federal agencies to insure that the local viewpoint on all problems can be given the fullest consideration.

At the end of the year plans were being made for closing the Civilian Public Service Camp for conscientious objectors on the Deschutes project. An average of 90 to 100 men were housed in the camp. The men assisted in clearing Wickiup Reservoir, puddling and priming the main canal, and with other work.

The one Japanese relocation center in region 1, situated at Hunt, Idaho, which had housed an average of 7,800 persons, was closed on October 23, 1946. This center was transferred to the Bureau of Reclamation on July 1, 1946. Some of the facilities will be disposed of to veterans who qualify for settlement of the 3,500 acres of land to be opened to homesteading during the coming fall.

Region 2

Irrigation service to more than one million acres of land, the resumption of a large-scale construction program, and electric power production amounting to nearly one and one-half billion kilowatt-hours, marked the operations of the Bureau in region 2 during fiscal year 1946. Total earnings of the Central Valley project during the year were in excess of \$4,000,000. Region 2 embraces three-fourths of California and the Klamath River Basin in southern Oregon.

In the Central Valley area alone, the Bureau furnished irrigation service to 360,000 acres of land throughout the fall months of 1945 and during the early weeks of the new irrigation season in 1946 was releasing stored water for irrigation on 645,000 acres. More than 100,000 acres on the

Klamath project and nearly 30,000 acres on the Orland project also received irrigation water from Bureau-constructed works.

In the Sacramento Valley, water released from Shasta Lake was being used on approximately a quarter of a million acres during the early part of the 1946 season. In the San Joaquin Valley, releases from Millerton Lake are used on 420,000 acres. This area is covered by fifteen interim contracts providing gross revenues of \$108,450 to June 30, 1946. This is about one-half the total returns expected for the entire 1946 irrigating season. Major changes in the amount of land served with irrigation water from facilities of the Central Valley project are not expected until after the Friant-Kern and Delta-Mendota Canals are placed in operation.

Large scale construction.—With the release from War Production Board restrictions early in the fiscal year, a large-scale postwar construction program was initiated. This program was based on specifications and other preliminary work accomplished during the war years. During the year, contracts amounting to more than \$21,800,000 were let for construction work on the Friant-Kern, Delta-Mendota, and Contra Costa Canals, and for the manufacture of auxiliary equipment at Shasta, Friant, and Keswick Dams. The first of these major contracts was for a 6-mile section of the Friant-Kern Canal, which was placed under construction by a private contractor on September 4, 1945. Additional contracts let on the Friant-Kern Canal during the year brought the total distance under construction to 72.8 miles. A contract for the first 14 miles of the 4,600 cubic-foot-per-second Delta-Mendota Canal was awarded on June 14, 1946. During the year, construction also began on the final section of the Contra Costa Canal, including a terminal reservoir near Martinez.

In addition to major work now in progress, the construction schedule for fiscal year 1947 includes the installation of spillway drum gates at both Shasta and Friant Dams, fourteen 108-inch valves in the spillway outlets at Shasta, completion of three penstocks for the Shasta power plant, and the erection of stairways, elevators, and other miscellaneous facilities at Shasta Dam. Work is under way also on erection of 50- by 50-foot spillway gates and related work at Keswick Dam. On the Contra Costa Canal, contracts have been awarded for the construction of the Ygnacio and Clayton pumping plants and construction of these facilities is expected to begin during the latter part of 1946. No major construction work is contemplated on the Orland project but on the Klamath project construction of the 110-foot high Boundary Dam is expected to start during the early months of fiscal year 1947.

Shasta power peaks.—Operating at approximately 13.5 percent overload throughout the entire year, the two 75,000 kilowatt generating units in the Shasta power plant produced 1,486,578,600 kilowatt-hours of electric energy. The generators at Shasta Dam were used to provide part of the

base load of the Pacific Gas & Electric Co., which takes the major portion of the output under a war-duration contract.

Interdepartmental sales of electric energy began on July 1, 1945, to the Delta pumping plants of the Central Valley project and to the steel pilot plant of the Bureau of Mines at Shasta Dam. The Bureau operated the Shasta substation section of the Shasta-Oroville transmission line. The remaining section of the line is under lease to the Pacific Gas & Electric Co.

On July 23, 1945, the city of Roseville signed an electricity supply contract with the Bureau for its municipal distribution system, calling for service to commerce by December 31, 1946. Extension of the Shasta-Oroville transmission line to Sacramento was authorized by the Congress and appropriations made for that purpose. Preliminary construction of the line started during the late months of fiscal year 1946. To carry out congressional mandates regarding the distribution of publicly generated power, it will be necessary ultimately to extend this transmission line to the Delta area near Tracy, Calif., to supply power service for Central Valley project pumps. However, this single 230-kilovolt transmission line cannot guarantee uninterrupted power supply without some type of standby service such as additional transmission lines or an auxiliary steam plant.

The Power Branch of the regional organization conducted economic studies for rate schedule purposes, and engaged in cost allocations and market studies during the year. In January 1946 it completed the first of a series of reports entitled "A Six-Year Advance Program of Power System Development—Fiscal Years 1947–1952."

At Shasta Dam, installation of miscellaneous power equipment and the erection of two 75,000-kilowatt generator units loaned to Grand Coulee for the actual duration of the war, began during the early months of 1946. This work will continue throughout the year with the expectation that these units will go on the line late in 1947. At the close of fiscal year 1946, the installation of miscellaneous power-plant machinery at Keswick Dam was in progress with plans in effect to continue this work throughout fiscal year 1947.

The fifth and final 75,000-kilowatt generating unit for the Shasta power plant is in process of manufacture and preliminary work in the power plant, looking forward to its installation, will be carried out during 1946 and 1947. Similar plans are in effect for installing three 25,000-kilowatt units at Keswick Dam.

Central Valley comprehensive plan completed.—Of major importance to the future development of the water resources of the Central Valley of California was the completion, on November 1, 1945, of the Comprehensive Plan for Water Resources Development—Central Valley Basin, California. During the year this report was submitted for review, as required by law, to the Governor of California and to other agencies concerned. At the close of the fiscal year the comments of the various reviewing agencies had

been received and steps are being taken to prepare the report in final form for submission to the President. This report emphasizes the necessity for coordinated and integrated development of the water resources of the Central Valley. Project planning forces of region 2 are engaged and will continue to be engaged throughout the coming year in the detailed investigations necessary to amplify the comprehensive outline presented in the basin-wide study. This work points ultimately to feasibility reports on the specific features proposed in the basin report.

A similar comprehensive basin-type report for the Santa Barbara area was transmitted to the President through the Bureau of the Budget on May 16, 1946. Investigations are continuing also in the Santa Barbara area with the added specific purposes of providing a basis for a repayment contract for irrigation and municipal water facilities as proposed for construction by the Bureau of Reclamation.

After a public hearing, conducted by the Corps of Engineers, at Klamath Falls, Oreg., and Yreka, Calif., in February 1945 on their proposal to divert Klamath River water into the Central Valley, there was widespread public demand for the Bureau of Reclamation to conduct a comprehensive study of the water resources of the Klamath Basin. In June of 1946 the Bureau established a project planning office at Klamath Falls to conduct this study. At year's end it was in progress and, due to the complexities of water distribution problems in the Klamath Basin, may take more than 3 years to complete.

Water storage benefits.—During the 1945-46 rainy season, storage in Shasta Lake reduced the flow of the Sacramento River at that point from 100,000 to 5,000 cubic feet per second, thus making a substantial contribution to flood protection on the lower reaches of the river. Stored water released from Shasta Lake produces power, aids in the propagation of salmon and other fish life, irrigates nearly a quarter of a million acres of crops along the Sacramento River, maintains a flow sufficient for navigation, furnishes the major portion of the flow necessary to prevent ocean water encroachment on 450,000 acres of rich Delta land, and via the Contra Costa Canal, supplies farms, large industries, and municipalities along the south shore of Suisun Bay.

For the second successive season, water passed the spillway crest of Friant Dam. Pending completion of the Delta-Mendota Canal, water from the Millerton Lake is used to satisfy the Miller and Lux exchange contract, furnishes water on an interim basis to 420,000 acres and via the Madera Canal delivers water for ground-water replenishment in the Madera irrigation district.

Water contract signed.—On October 18, 1945, the board of directors of the Southern San Joaquin municipal utility district signed the first water contract ever consummated under the provisions of section 9 (e) of the Reclamation Project Act of 1939. This contract provides for the delivery

of a maximum of 91,000 acre-feet of class I water and 33,000 acre-feet of class II water annually from the Friant-Kern Canal. Contract negotiations with three additional districts were in advanced stages on June 30, 1946, and negotiations, including studies of irrigation distribution systems, are in various stages of completion with nine other districts in the Friant-Kern Canal service area.

The Contra Costa Canal was operated during the year to deliver 11,590 acre-feet of water under an interim contract which returned a revenue of \$43,450, an amount sufficient to cover operation and maintenance costs. In the absence of an irrigation distribution system, 7 percent of this water was used for agricultural purposes from canal-side pumping, while 78 percent was consumed by industries and 15 percent by municipalities. Negotiations for a permanent contract including arrangements for irrigation distribution systems are currently in progress with directors of the district.

During the year a wide range of studies including 1945 crop surveys, weed surveys, analyses of excess land holdings, consumptive use studies, preliminary water requirements, land classification, cost allocation studies, and related investigations were completed in preliminary stages and most of them will be carried forward on a more detailed basis during the ensuing year on present and proposed projects within the region.

Of primary importance to the Central Valley project was the cost allocation study, which was in an advanced stage of completion at the end of the year.

Region 3

The Bureau's hydroelectric plants on the lower Colorado River, producing about half of the power generated on all Bureau projects; continued to make region 3 the "powerhouse" of the Southwest. Water used in the generation of power was reused to irrigate hundreds of thousands of acres served by Reclamation facilities.

Having supplied about half of the power needs of the Los Angeles metropolitan area during the war years in addition to serving areas in Arizona and southern Nevada, power generated by Boulder and Parker Dams is now playing an equally important part in the Southwest's reconversion program. The Salt River Valley, Yuma Valley, Imperial Valley, and other irrigated areas served by Reclamation facilities are continuing their high rate of production, established during the war, to help bolster the Nation's short food supply.

The Boulder and Parker power plants, and a small plant on the Yuma project, generated a total output of about 5½ billion kilowatt-hours during the fiscal year 1946. Crop production for the calendar year 1945 from 741,843 acres served by Reclamation facilities was valued at \$111,509,257, about the same as for the previous year.

On VJ-day the Bureau was given the "green light" to proceed with projects held up by the war. The construction program on projects in this region was accelerated. Construction of Davis Dam, 67 miles downstream from Boulder Dam, was officially begun April 19 by the contractor, the Utah Construction Co. Construction of irrigation systems and predevelopment of land on the Gila project near Yuma, Ariz., and extension of the Coachella Main Canal in southern California, were accelerated.

Davis Dam.—Contract for construction of Davis Dam and powerhouse, largest Colorado River project since the completion of Boulder Dam in 1936, was awarded to the Utah Construction Co. in January at a contract price of \$21,462,505. Total project cost, including generating machinery and transmission system, is estimated at \$77,000,000. A construction camp has been established at the damsite and more than one thousand construction workers are now actively employed. The construction period will extend over 3½ years.

Primarily designed as a power project, Davis Dam will also provide regulation of the river flow below Boulder Dam for the benefit of irrigated areas in this country and Mexico, together with incidental benefits to wildlife and recreational interests.

The Davis Dam power plant will have an installed generating capacity of 225,000 kilowatts, bringing the region's hydroelectric capacity to more than 1⅓ million kilowatts and adding from three-quarters of a billion to a billion kilowatt-hours annually to the present output along the river.

Transmission systems.—The second Parker-Phoenix 161-kilovolt line was completed, except for relay protection, and was placed in operation on a temporary basis.

Contracts covering major items of terminal equipment for the Parker-Gene 230-kilovolt interconnection were awarded. The interconnection, scheduled for completion during the next year, will provide an additional 90,000 kilovolt transformer bank to the present tie between the Parker and Boulder transmission systems.

Coachella Main Canal.—This vital water artery, which will irrigate some 75,000 arable acres of land in the rich Coachella Valley of southern California, is expected to be completed sometime in 1948. Almost 90 percent of the 145-mile-long canal, which is a branch of the All-American Canal System, was completed or under contract.

The Coachella Valley County water district currently is considering a supplemental repayment contract for the construction of a distribution system to serve the valley. The contract would authorize the Bureau to request funds from the Congress for the construction of a distribution system. Emphasis is upon the early relief of the present planted acreage in the valley for which the existing water supply from underground sources is inadequate.

Gila project.—On the Yuma Mesa division of this project, over 6,000 acres of land are leveled. Some 3,500 acres are planted to alfalfa or to a nurse crop. The Yuma Mesa division contains about 40,000 acres of land in public ownership which will be made available for homestead entry at a future date. About 10,000 acres of public land are slated for initial settlement by veterans late in 1947.

On the Gila project, ditch test sections were prepared by oil treatment as a part of the experimental work in seeking means by which water losses in farm ditches may be reduced. Plans were made during the last quarter of the fiscal year to extend this activity and, under a joint program sponsored by the Branches of Operation and Maintenance and Design and Construction, to determine the most economical methods for preventing water losses in canals, laterals, and farm ditches.

East Mesa.—Land classification surveys on East Mesa, All-American Canal System, were continued and a final report was prepared. Preliminary negotiations with the Imperial irrigation district regarding a distribution system for 10,000 acres were begun. This area will serve as a full-scale trial or demonstration of the agricultural possibilities of the mesa soils.

Yuma project.—Plans were largely completed for connection of the Bard irrigation district, reservation division, laterals to the All-American Canal. Construction of these connections will be under way early in the fiscal year 1947. The connections will provide greater operating flexibility for the lower Colorado irrigation program and will permit the opening of Laguna Dam for sluicing silt and sand deposited between Imperial and Laguna Dams by the desilting works. Laguna Dam thus will become an operating adjunct of Imperial Dam and a part of the All-American Canal System. Work was initiated to establish the factual basis of recommending a rehabilitation program for the Yuma project.

The soil and moisture conservation program on the Yuma project was continued, activities consisting mainly of the accumulation of additional information regarding ground-water levels in relation to the volume of water diverted into the canal and lateral system. The program for the fiscal year 1947 was formulated with special emphasis on the possible influence of irrigation of the new lands of the Yuma Mesa of the Gila project on the valley lands of the Yuma project and the South Gila irrigation district. The grid of observation wells will be increased in number, and the work will be carried on jointly by the superintendents of the Yuma and Gila projects and coordinated by the district engineer.

Weed control.—On both the Yuma and Gila projects, an intensified program of weed control was launched. Systematic burning of weeds along canal banks of the Yuma project will be continued throughout the fiscal year 1947. The use of oil spraying and new chemical methods of weed control, separately and together with burning, was investigated on the Yuma project.

On the All-American Canal project, the regional weed-control specialists assisted the project forces in establishing an effective program for the removal of the vegetative growth in the All-American Canal.

Present plans for the rehabilitation and maintenance work in the All-American Canal upstream as far as Pilot Knob wasteway will be effected by December 1946.

Colorado River Basin Report.—Regions 3 and 4 are jointly responsible for completing a comprehensive report entitled "The Colorado River, 'A National Menace Becomes a National Resource.'" This report inventories water and other resources in the Colorado River Basin, summarizes the present irrigation, power, and municipal uses of water of the Colorado, and presents future developmental possibilities for the use of Colorado River water for irrigation, power, municipal supply, and other beneficial purposes. The report describes 134 projects, or units of projects, which could be developed in the natural drainage basin of the Colorado River and recognizes that additional potential projects outside the Basin could be supplied by the exportation of Colorado River water. The construction cost of the 134 projects, or units of projects, is estimated to be 3½ billion dollars based on present prices. The possibilities for use of water exceed the water supply. The report therefore suggests that the States concerned recommend a group of projects which will fall within the ultimate allocable supply available and that the States mutually settle upon their respective rights to Colorado River water.

Sub-basin and project reports.—Region 3 has been preparing sub-basin reports on the Virgin, Little Colorado, and Muddy Rivers and recently started investigations in the Upper Gila sub-basin, New Mexico. Reports on nine comparatively small irrigation projects in Utah, Nevada, and Arizona were in the course of preparation; on two of these, preliminary drafts have been circulated. In addition, engineering field studies were made of a combined intake for the Palo Verde irrigation district and a possible Palo Verde Mesa irrigation project, California. A preliminary report was prepared, and circulated, of costs and route to be followed to furnish San Diego, Calif., with Colorado River water from the All-American Canal.

Central Arizona project.—An important cooperative investigation, the Central Arizona project, in which Arizona matches funds to the extent of \$200,000, is being carried on to study the furnishing of Colorado River water as a supplemental supply to about 600,000 acres in the valleys of the Gila and Salt Rivers near Phoenix, Ariz., where excessive pumping has depleted the ground water supply and where the lack of water has become a serious threat to this highly developed area.

A comparison report, distributed in preliminary form in October 1945, reduced the consideration of possible feasible aqueduct routes from three to two. Since then, there has been in the course of preparation an interim report taking up the furnishing of Colorado River water to central Arizona

from a diversion at the potential Bridge Canyon Reservoir. From this reservoir, water would be conveyed through the potential Big Sandy Tunnel, about 80 miles long, then in an aqueduct 248 miles long to the potential McDowell Reservoir on Salt River east of Phoenix. If Bridge Canyon Dam is built, silt storage will be needed on the Colorado River system upstream. A start has been made toward investigating a silt storage reservoir at the Coconino site on the Little Colorado River.

A second interim report will cover investigation of an aqueduct that would supply Colorado River water to central Arizona from Havasu Lake above Parker Dam. In this case water would be elevated about 1,000 feet by pumping to the aqueduct, then carried about 235 miles to Granite Reef Reservoir on Salt River east of Phoenix.

River control.—The regional office of river control was established for the primary purposes of formulating and executing plans for physical control of the Colorado River and its tributaries within the region, to control and apportion the water of the river according to intended functions, and to handle administrative problems arising under the Mexican treaty.

The regimen of the river has been and will continue to be altered by the construction of Boulder, Parker, and other dams. This fact has introduced many difficult problems. The silt-bearing river, deprived of its silt, issues clear below the dams in a channel previously adjusted through the ages to accommodate silt-laden water. Under such circumstances it is a natural phenomenon for the clear river to strive to recharge its silt load, and to adjust its alignment and grade for restoration of the natural characteristics. The river bed further downstream becomes unstable with an increased tendency to meander, raising the elevation of the river bed and forcing the deposition of silt to progress upstream until a new balance is reached.

The "Needles situation," over the entire 12-mile section of the river from Needles to Topock, is an example of this building up of the valley floor. Emergency measures to control this situation are now in progress. Permanent correction of the situation has been provided by an act to amend the laws authorizing the performance of necessary protection work between the Yuma project, near the Mexican border, and Boulder Dam, some 300 miles up the river. This act was signed by the President during the latter part of June 1946. While this act authorizes the Bureau to perform the work necessary for the permanent alleviation of this section of the river, it makes no appropriation of funds.

Specifications were prepared for the proposed dredging of the river channel at Needles. These specifications will be formally advertised during the next year.

Emergency measures at Needles consisted of the raising of the protecting levee to within about one foot of its designed grade, the placing of riprap along the riverward face at critical sites, and the continuous pumping of seepage water from the affected areas in the outskirts of the city.

To penetrate the dense swamps of tules, willows, cottonwood trees, and other vegetation in the valley sections of the river, Bureau survey parties are now using amphibious vehicles officially known as the Mark 3 landing vehicle (LVT-III). These amphibians, like those that stormed the beaches of the southwest Pacific in the latter months of the war, carry the surveyors to points in the swamp which previously were almost inaccessible. In addition, surplus walkie-talkie two-way radio sets are being used by the surveying parties to maintain constant contact.

In addition to the physical control of the river bed, the office of river control administers the control of water, which is necessary for the conservation of supply and achievement of maximum benefits. This control includes the dispatching of water required for irrigation, flood control, navigation, domestic use, power generation, and fulfillment of the Mexican treaty obligations, as controlled through release of reservoir storage and balanced against the available supply.

The control of water begins with forecasting the supply which will be available. To this end, investigation of forecast methods has been carried on. Forecasts of inflow to Lake Mead have been made by this office during the years 1945 and 1946.

As the 1946 snow run-off season on the Colorado River approached, it was apparent that inflow to Lake Mead would be far below normal. Accordingly, beginning with June 1, 1946, the start of the new power contract year, releases from Boulder Dam were reduced to the minimum necessary to satisfy downstream demands for irrigation and other uses. A system of careful daily scheduling of releases from Boulder and Parker Dams for 1 week in advance was initiated, in order to reduce run-off to the Gulf of California to a minimum. Such a system of scheduling must be followed in years of water shortage. In years of excess run-off, on the other hand, when flood waters must be accommodated, it will also be necessary to schedule releases carefully. The problem then will be to provide storage space for future floods, at the same time keeping the flow low enough to avoid damage to lands along the river.

San Diego aqueduct.—The 71.5-mile San Diego aqueduct was originally planned and financed as a war measure to provide a supplemental water supply from the Colorado River for the naval installations and war industries in the San Diego area, and the war-swollen population drawn into that area by these activities. Preconstruction surveys by the Bureau of Reclamation were completed in June 1945, plans and specifications were prepared in the Chief Engineer's office, and the last of the seven contracts into which the job has been divided was awarded by the Navy in November.

Following VJ-day immediate cancellation of all these contracts, threatened by the Navy, was averted only by the signing of a contract by the city of San Diego agreeing to repay the Navy over a 30-year period the entire construction cost. Work under all contracts is now in progress under Navy supervision, with the Reclamation Bureau as consultant assisting in

inspection of field work and review of ship drawings and proposed changes of construction plans to fit field conditions.

Lower Colorado River district.—As of June 1 the lower Colorado River district was established with a district engineer at Yuma in administrative charge, under the Regional Director, of Gila project construction, Gila project operation and maintenance, Yuma project operation and maintenance, and Imperial division, All-American Canal, construction and operation and maintenance. Simultaneously, the Coachella division, All-American Canal, was established as an autonomous project, under a construction engineer reporting administratively direct to the Regional Director.

Region 4

The transition from war to peace in region 4 during fiscal year 1946 was marked by the need of expanding the investigation and construction programs in the face of continued war scarcities including housing, equipment, and materials of all kinds; the necessity for new economic studies in connection with the new crops and crop values developed during the war, and the detail work of negotiating amendatory repayment contracts to match the increased costs of construction and the changed economic status of existing irrigation projects.

Under War Production Board and War Food Administration priorities, the Scofield, Utah, and Newton, Utah, projects were continued to completion approximately as planned. Some work was accomplished by the Bureau on the Mancos, Colo., project with the help of a Civilian Public Service camp, but since February 1946 little has been done pending authorization of new funds.

As the labor situation improved, activity increased on the Provo River project, Utah, where employment of 61 additional employees increased total personnel to 143. Construction of a 10½-mile section of concrete pipeline for the Salt Lake aqueduct was finished, bringing to completion 27 miles of the 40-mile conduit that will carry water to Salt Lake City and surrounding area. Eighty percent of the excavation for the enlargement of the Provo Reservoir Canal was accomplished and the last of the siphons, except the Jordan Narrows siphon and pumping plant, were installed in the canal line. Work was nearly completed on the Weber-Provo Diversion Canal with the construction of several irrigation structures and the placing of concrete lining in some sections, leaving 4,000 feet of concrete lining as the only work yet to be done on the canal. Work has not yet been resumed on the 6-mile Dushesne Tunnel, nearly half completed in 1942 when a War Production Board order halted construction.

Completion of the dams for the Newton and Scofield projects during the year brings the number of reservoirs in the region to a total of 16, with an aggregate active capacity of 2,125,000 acre-feet of water. These reservoirs, together with natural flow for direct use, supplied irrigation water to 16

operating projects, the Provo River and the Scofield projects being operated during construction.

Crop production up.—For the calendar year 1945, during which water supply conditions were favorable, 486,600 acres in cultivation produced crops valued at \$38,120,000. This represents an increase of \$3,420,000 over calendar year 1944. In addition, some water was delivered and crops were grown under the old privately constructed irrigation systems on the Mancos and Eden projects where construction of dams had been commenced by the Bureau, but suspended during the war.

Alfalfa and grains maintained their position as top producers on irrigated lands in region 4 and are important crops to the livestock and dairy industries of the intermountain area. Potatoes, sugar beets, truck crops, and fruits are gaining in favor.

The ability of the Bureau reservoirs to furnish domestic and industrial water supplies as well as irrigation water will continue to be an important factor in the industrial development of the region. Transfer of the Geneva steel plant, which receives water from the Provo River project, from Government to private ownership with assurance of continued and increased operation of this industry gives promise of industrial expansion and growth for the intermountain area.

Bureau reservoirs continued to plan an important role in providing recreational facilities for the intermountain area. Many of them are near relatively thickly populated areas and provide boating, swimming, and fishing activities while others are more remote, but make up in scenery and excellent fishing for the extra distance that must be traveled to reach them. Thousands of vacationists have enjoyed the facilities afforded, and indications point to the growing importance of, and necessity of planning for, reservoirs as recreational areas.

Reclassification survey.—A detailed land reclassification survey and economic study on 130,000 acres of the Uncompahgre project was completed as was a detailed land classification of the Lyman project, Wyoming, and semidetained land classification of the Malad, Idaho, and South Cache, Utah, projects. Reconnaissance land classification of the Upper Gunnison project, Colorado, and semidetained land classification of the Glendale-Mapleton project, Utah, and Bear River project, Utah, Wyoming, and Idaho, were planned for completion within the fiscal year 1947. In addition, economic surveys for the Ogden and Provo River project areas are in final stage. These surveys to determine the water users' repayment ability will furnish a basis for consideration of amendatory repayment contracts which are expected to be negotiated during the ensuing fiscal year.

An active weed control program has been developed cooperatively with Federal, State, and private agencies. Concurrent research programs to develop technical information and determine adaptability of new chemicals and new procedures to weed work were instituted at the same time.

Total personnel increased from 302 to 638 during the year. Most of this increase was required to initiate preliminary investigations of potential projects and to accelerate schedules delayed by loss to war work of men trained in reclamation planning. Forty-one employees returned from military furlough and approximately 70 percent of other additions were veterans. Field offices were expanded at Logan and Vernal, Utah; Carson City, Nev.; Durango, Grand Junction, and Gunnison, Colo. New offices were opened at Kemmerer, Wyo., Steamboat Springs, Colo., and Spanish Fork, Utah. The Provo River project office nearly doubled and plans were made for the early establishment of Bureau offices at Naturita, Colo., and Ogden, Utah, with still other localities under consideration as sites for offices yet to be set up.

River Basin studies.—Basin-wide studies, designed to formulate a pattern for the greatest ultimate development of the three major drainage basins in region 4, were completed during the year and reports completed or nearly so far all three basins. The Colorado River report, written in cooperation with region 3, and covering some 134 potential projects, project extensions or other important units, was approved June 7, 1946, and submitted to reviewing agencies. The Bonneville Basin report, including approximately 25 potential developments, has been completed in draft form. The Lahontan Basin report covering approximately 20 potential projects was nearing completion at the close of the fiscal year.

Detailed surveys of specific projects will command principal attention in the region for the next year. A report on the Paonia project, Colorado, has been submitted to the Governor of Colorado, to the Secretary of War, and to the Federal Inter-Agency River Basin Committee. Reports on the Hammond project, New Mexico, and the Gooseberry project, Utah, have been completed in draft form. Other projects upon which reports are nearing completion include: Malad Valley project, Idaho; Silt, West Divide, Fla.; Dolores and Pine River Extension projects in Colorado; La Plata project, Colorado-New Mexico; Emery County, Jensen, and Vernal projects, Utah; and the Lyman project, Wyoming. Detailed investigations are also under way on about 20 other projects.

It is expected that the way will be cleared in the near future for resuming construction on the Mancos, Colo., and Eden, Wyoming, projects which with the Provo River project and a small amount of work to complete the Ogden River project will make up the construction program for the next fiscal year.

Power investigations.—Power, as an aid to irrigation and industrial development, is becoming of increasing importance and, of the many possibilities in region 4, the Diamond Creek, Echo Park, and Truckee-Carson potentialities have been chosen for detailed investigations during the following year. Population growth and industrial expansion in region 4 continues at a rapid rate. Development of multipurpose projects to provide

at the earliest possible moment the two major needs (irrigated farm homes and electrical energy) has become a necessity.

The 1,690-acre Pitt Ranch on the Humboldt River, purchased by the Government during acquisition of water rights was sub-divided and disposed of during the year. Thirty-five right-of-way purchase contracts were completed on the Provo River project and new or renewal leases for Bureau-owned or controlled lands were executed on approximately 21,000 acres.

The heavy demands for equipment, materials and supplies were met without serious delays despite critical market conditions in general. Old Civilian Conservation Corps buildings were converted into housing units at two locations and 51 Federal Public Housing Authority units were obtained for a housing project in western Colorado; 22 house trailers were purchased to alleviate the housing shortage; surplus property proved an excellent source of supply for critical items.

Material on Reclamation's role in conservation of natural resources was prepared at the request of the Utah Department of Public Instruction, for inclusion in their manuals for the seventh grade, twelfth grade, and adult classes.

Region 5

Six projects were in operation or under construction in region 5 of the Bureau of Reclamation at the end of fiscal year 1946. Nine river basins, three important subbasins, and 24 projects were under investigation, and reconnaissance or preliminary study was being made of 18 projects. Land development programs were in progress on two projects under construction. Transmission systems were fanning out from Elephant Butte Dam, delivering 109,361,526 kilowatt-hours of energy and bringing in revenue amounting to \$359,226.

Highlights of the year were: opening of the new Balmorhea, Tex., project; dedication of the Lugert-Altus Dam near Lugert, Okla.; and formation of an irrigation district at Canton, Okla.

First contract for the Balmorhea project was awarded June 19, 1946. The project is designed ultimately to provide supplemental water for 7,400 acres now receiving an inadequate supply, and a full water supply for 3,260 acres of new land.

The Lugert-Altus Dam was dedicated at an impressive ceremony on January 30, 1946. It is a concrete gravity-type, partially curved structure rising approximately 100 feet above the North Fork of the Red River, and has a crest of 1,160 feet. The reservoir, with a capacity of 163,000 acre-feet, impounds water for the ultimate irrigation of between 60,000 and 70,000 acres in the Lugert-Altus irrigation district.

Landowners along the North Canadian River in Oklahoma voted December 4, 1945, to form the Canton irrigation district of 21,710 acres in

the area from Canton to Karns Spur. The vote was 96 to 42. Final draft of the Canton project report is in the process of reproduction.

Major activities of region 5 during the 1946 fiscal year are outlined in the following reports of various branches and divisions.

Construction.—Five projects in region 5 are now under construction. These comprise: Tucumcari, N. Mex.; Altus, Okla.; Balmorhea, Tex.; Rio Grande (storage and power division only); and Marshall Ford Dam on the Colorado River of Texas.

Water for the Tucumcari project is obtained from the Conchas Reservoir on the South Canadian River, and is brought to the irrigable 45,000 acres by a canal of total length of 77.3 miles. The project is 68 percent complete, with expenditures amounting to \$9,493,000. A total of 56 miles of the Conchas Canal has been completed, and irrigation is now available for the first 6,672 acres. Five tunnels and 33 concrete siphons are in the canal system.

The Lugert-Altus Reservoir on the North Fork of the Red River provides water for the Altus project. The dam is 99 percent complete. The main canal and a portion of the Altus Canal are complete, and irrigation of the first land is under way. The project is 57 percent complete, with total expenditures of \$6,809,170. The project includes 52,000 net acres of irrigable land. Work is under way on the Altus Canal, the West Canal, Altus City pipe line, and the Altus Blair and West laterals and sublaterals.

First contract for the Balmorhea project was awarded June 19, and construction is expected to start during July 1946. Expenditures to date total \$38,000. The project is 10 percent complete on a cost estimate.

The storage and power division of the Rio Grande project is approximately 86 percent complete. Expenditures to date total \$10,314,645, and the cost of work yet to be performed was estimated originally at \$1,748,000. Remaining work includes construction of transmission lines to Alamogordo and Hollywood, N. Mex., and from Elephant Butte Dam to Socorro and Albuquerque, N. Mex. Spillway repairs will be made on Elephant Butte Dam at an estimated cost of \$150,000.

Expenditures on the Marshall Ford Dam to date total \$23,914,209. This structure will be turned over to the Lower Colorado River Authority in the near future in accordance with the contract of 1941. Remaining work will be performed with \$68,400 appropriated by the Congress for 1947.

Authority was delegated in January 1946 to the Design and Construction Branch to prepare preliminary designs and cost estimates for project planning feasibility reports, and this work was carried out as authorized on the Canton, Okla., and Hudspeth, Tex., projects. Reviews of project reports with reference to design features and cost estimates have been made for the Robert Lee, San Angelo, Fort Sumner, and Balmorhea projects. Special reports were completed for the Carlsbad project and Guadalupe Basin Report. These reviews included an analysis of 1940 and present day

construction costs, and a review of design and construction features with recommendations.

Scheduled work.—The major part of the Tucumcari project is scheduled for completion in the 1947 fiscal year, with remaining lateral construction work and drainage extending into 1948. An expenditure of \$4,462,332 is planned in 1947 and 1948 to complete the project. All funds are now available for use.

The Altus project is scheduled to be completed by end of the middle of 1948. Future work will include construction of the Ozark canals, Ozark laterals and sublaterals, and drainage work. Appropriation for the remaining work total \$5,091,610.

Completion of the storage and power division works in the Rio Grande project area is scheduled to be completed during fiscal year 1948.

Work remaining on the Colorado River project, Texas (Marshall Ford Dam) includes the purchase and installation of a gantry crane and a standby generating unit, road repair, painting of damaged areas and miscellaneous work all to be completed in 1947.

All work on the Balmorhea project is scheduled for completion in the 1947 fiscal year when the remaining \$342,000 of the total estimate cost of \$380,000 will be expended in the construction of Phantom Lake Canal and the Inlet Feeder Canal. These canals are expected to deliver water by November and December 1946, respectively. Expenditures to date total \$38,000.

Plans are being developed for the possible start of construction work in the 1948 fiscal year on the San Luis Valley, Valley Gravity, Fort Sumner, and Canton projects.

Planning developments.—Planning work for water resources development included investigation of 9 river basins, 3 important subbasins, 24 projects, and reconnaissance or preliminary study of 18 projects. In addition, detailed surveys and preparation of construction plans were in progress for 3 projects.

Drafts of reports on the Nueces and the Rio Grande Basins, and the Middle Rio Grande project have been completed. The close of the fiscal year also found final drafts of the Canton, Robert Lee, and Balmorhea project reports in the process of reproduction.

Preliminary reports have been prepared on the Fort Sumner and Tucumcari water supply projects.

During the first quarter of the fiscal year 1947, it is expected that reports will be completed for the Canton, Robert Lee, Balmorhea, San Angelo (North Concho), Fort Gibson Reconnaissance, and Hudspeth projects, the Guadalupe and Arkansas River Basins, Rio Grande project recreation and Carlsbad project recreation. During the second quarter, completion of reports is scheduled for the Fort Sumner, Mud Creek Reconnaissance, and San Luis Valley (Conejos division) projects.

In the third quarter, reports are scheduled to be completed for Capulin Reconnaissance, Valley Gravity, Englewood and San Luis Valley (Rio Grande division) projects, and for the Washita River subbasin. During the fourth quarter, reports are to be completed for the Black Mesa Reconnaissance, Mora Reconnaissance and Kenton projects, and for the Pecos River subbasin.

Major operation and maintenance activities were confined to four projects in operation or under construction.

Rio Grande project.—Some 154,862 of the 178,073 acres in New Mexico and Texas in the project area were irrigated in 1945. The 6,518 irrigated farms in the area had a population of 33,060. Gross crop returns for 1945 were \$22,389,974, an average gross return of \$144.58.

Carlsbad project.—One of the oldest irrigation projects in the Western United States, the Carlsbad project is in critical need of rehabilitation. An economic study is being conducted as a basis for definite plans to accomplish this restoration. The project embraces 25,055 acres in the Pecos River Valley of New Mexico. Drouth increased the water shortage problem in 1945 when 20,715 acres were under irrigation. There were 459 farms in the area, with a population of 1,954. Gross crop returns were \$1,539,966, an average of \$74.34 an acre; a decrease of \$300,000 and \$13, respectively, over 1944 returns.

Altus project.—Irrigation facilities to serve approximately 1,300 acres of project lands were completed by June 30. When completed, the Altus project will contain approximately 55,000 acres of irrigable land. Dry-land farming on 71,167 acres in the area resulted in gross crop returns of \$1,631,297 for 1945, an average of \$24.59 per acre. There were 512 farms in the area with a population of 996.

Tucumcari project.—Land development work has been done on 3,899 acres of the 45,000-acre project, and 1,544 acres have been smoothed for irrigation. An estimated 900 acres of wheat and 40 acres of alfalfa were planted in the fall on developed irrigable land. This was irrigated in the spring, and a good stand of wheat was secured. The project was not operating at the close of 1945, and lack of preirrigation data prevented the compilation of a crop and livestock report.

The 1947 program is designed to help farmers solve important problems in connection with the first use of irrigation water. The program includes: advising in the use of water; predevelopment of farm land, advice on farm management, completion of farm unit studies for use in directing settlement, and water duty studies for scheduling economic consumption and delivery of water.

Power facilities.—A 115,000-volt transmission system from Las Cruces to Alamogordo Air Field, N. Mex., was completed last year. The 70-mile line was built for delivery of power to Alamogordo Air Field and the White Sands Proving Ground.

The Bureau's power facilities for region 5 consist of a hydro-generating plant at the toe of Elephant Butte Dam and transmission system. The Elephant Butte plant consists of three 8,100-kilowatt generating units with an estimated annual salable output of 107,000,000 kilowatt-hours. Total energy delivered for the fiscal year 1946 was 109,361,526 kilowatt-hours, with an electric revenue of \$359,226.92. Power has been allocated equally for use in New Mexico and Texas. Two hundred and twenty-five miles of transmission lines are used to market the power over the area of southern New Mexico and El Paso, Tex.

The transmission system consists of the following lines: Elephant Butte to Deming, N. Mex., for delivery of power to the Deming Ice & Electric Co., 76.20 miles, 115,000 volts; Deming to Central, N. Mex., for delivery of power to the Community Public Service Co., 42.32 miles, 115,000 volts; Elephant Butte to Hot Springs, N. Mex., for delivery of power to the town of Hot Springs, 3.75 miles, 13,800 volts; Elephant Butte to Las Cruces, N. Mex., 63 miles, for delivery of power to the El Paso Electric Co.; Las Cruces to Alamogordo, 70 miles, 115,000 volts.

The following transmission lines are under construction or authorized: Alamogordo Air Base to Hollywood, N. Mex., for delivery of power to Community Public Service Co. at Alamogordo and Hollywood and Otero County Electric Cooperative at Alamogordo and Hollywood, 55 miles, 115,000 volts; Elephant Butte to Albuquerque for delivery of power to Socorro Electric Cooperative at Socorro, N. Mex., Community Public Service Co. at Socorro and Albuquerque Gas & Electric Co. at Albuquerque, N. Mex., 150 miles, 115,000 volts.

Proposed additional plants include El Vado, 10,000 kilowatts scheduled in 1949; Chamita, 15,000 kilowatts in 1950; and Abiquiu, 15,000 kilowatts in 1953. These plants will be located in the north central part of New Mexico on the Rio Chama.

Region 6

The Flood Control Act of 1944 approved the comprehensive plan of the Bureau of Reclamation and the Corps of Engineers for the conservation, control, and use of the water resources of the Missouri River Basin, and contained authorization for the construction of its initial stages.

During fiscal year 1946, the activities of region 6 have been largely concentrated on work required to bring the first six authorized units up to the construction stage, including the preparation of construction plans and specifications, and this work has been practically completed for the following units:

The Boysen Reservoir on the Big Horn River in Wyoming will store 820,000 acre-feet. A power plant at the dam will have an installed capacity of 15,000 kilowatts. The reservoir will provide flood control for lands along the Big Horn River and will afford immediate silt control. Stored

water will be used as insurance for existing water rights on the Big Horn River in Wyoming and Montana and on the Yellowstone River below the mouth of the Big Horn when additional irrigation is developed in either or both basins. Contracts have been awarded for the erection of an engineer's camp and construction of a transmission line to supply power for construction. Bids have been opened for the reconstruction of 4½ miles of United States Highway 20.

The Owl Creek unit, in Wyoming, consists of the Anchor Reservoir, which will provide 14,500 acre-feet of storage, and the Lucerne pumping plant which will provide water by pumping from the Big Horn River, both to be used as supplemental water for 14,400 acres in the Owl Creek Valley now inadequately irrigated. Plans are complete.

The Angostura unit on the Cheyenne River in South Dakota will provide water for 16,000 acres to be served by gravity, and 25,000 acres to be served by pumps. Storage of 92,000 acre-feet will be provided by Angostura Reservoir which will also serve as a diversion dam. Bids for the construction of this dam have been opened.

The Tiber Dam on the Marias River in Montana will store 340,000 acre-feet and divert water for the irrigation of 120,000 acres on the north side of the Marias River. Plans and specifications for the Tiber Dam are nearly complete. Topographic surveys and land classification of project lands are under way.

Plans and specifications for the Canyon Ferry Dam on the Missouri River near Helena, Mont., are complete. The reservoir formed by this dam will have a capacity of 2,000,000 acre-feet. It will be used to insure protection for all water rights in the upper Missouri Basin, both above and below the reservoir when additional irrigation development is undertaken. A power plant of 36,000 kilowatt capacity will be provided.

Plans and specifications for the Heart Butte Dam on the Heart River in North Dakota are complete. The reservoir formed by this dam will provide storage of 300,000 acre-feet, of which 55,000 acre-feet will be available for the irrigation of 13,500 acres to be served partly by gravity and partly by pumping. Also included in the Heart River unit will be the Dickinson Reservoir, which will provide storage of 7,000 acre-feet, partly for municipal use at the town of Dickinson and partly for irrigation by pumping.

In addition to the above, plans and specifications are nearly completed for the Savage pumping unit in eastern Montana, which will serve 2,390 acres, and for the Square Butte and Wogansport pumping units along the Missouri River in North Dakota, to provide water for 3,500 acres.

Surveys and investigations.—During the fiscal year, surveys have been in active progress to obtain data for the preparation of plans and specifications for the Missouri-Souris unit, including the Cheyenne River Dam in Montana and North Dakota; the Hardin unit, including Yellowtail Dam,

in Montana; the Grand River and Knife River units, and pumping units in North Dakota, and Paintrock unit in Wyoming.

Reconnaissance work has been in active progress at a number of points in the region, including the proposed diversion from Garrison Reservoir in North Dakota.

Contracts have been awarded to provide topographic maps to be used as a basis for further investigations of the Tongue, Clarks Fork, and Powder River Basins. Another contract covers aerial photography of irrigable lands in the Grand River Basin, N. Dak., Missouri-Souris unit, Montana and North Dakota, the Teton Basin in Montana, and Tongue and Powder River Basins in Montana and Wyoming. Rectified aerial photographs on a scale of 1 inch to 400 feet will be used as a basis for detailed land classifications and topographic surveys. Aerial topography has already been secured for the Yellowtail Reservoir site in the Big Horn River Canyon and for the canal line location between Tiber Reservoir and the project lands on the Lower Marais unit. Aerial photographs of the project lands under the Lower Marais unit have also been procured.

The Intake project, near Glendive, Mont., was constructed during the fiscal year and is being operated, for the first time, in 1946.

Deerfield Reservoir, the major feature of the Rapid Valley project, is practically complete. Water was being stored, at the end of the year, for supplemental supplies for lands irrigated in the Rapid Creek Valley, and to augment municipal supplies for Rapid City, S. Dak.

Contract was executed for the construction of Dodson pumping unit of the Milk River project. Repayment contract has been executed with the Dodson irrigation district, and the project will be completed in time for water delivery in 1947.

Contract was executed for the construction of the Big Flat unit, Missoula Valley project in the Columbia Basin unit, and will be completed for water delivery in 1947.

Contract has been executed for the construction of the Fallon unit of division No. 2 of the Buffalo Rapids project.

Surveys for the completion of the Riverton project in Wyoming have been in active progress. Two construction contracts have been executed and work under them is in active progress.

Surveys for the completion of the Heart Mountain division of the Shoshone project have also been under way. Two construction contracts have been executed. Preparations have been made for the opening to entry of 83 farm units of public land in fiscal year 1947. Plans and specifications for the construction of the Heart Mountain power plant on the Shoshone project have been completed.

On the Sun River project, the Pishkun siphon was completed.

On the Fort Peck project the 115-kilovolt transmission line from Fort Peck to Glendive was completed, and was energized on December 1, 1945.

Plans and specifications were completed for the 115-kilovolt transmission lines from Glendive to Miles City, Mont., and from Fort Peck, through Williston, N. Dak., to Garrison Dam in North Dakota. The portion from Williston to Garrison is considered a part of the Missouri Basin project.

On the projects constructed by this Bureau in region 6, farm operations in 1945 were generally successful and crop yields were good. Crops valued at \$14,079,000 were produced on 360,000 acres. In addition, large numbers of livestock were produced and marketed. Production included 428,000 tons of sugar beets, or 6.5 percent of the Nation's total. Other major crop items included 502,000 bushels of beans; 550,000 bushels of potatoes, and 3,375,000 bushels of grains. A large part of the grain was fed to livestock locally.

The Fort Peck power plant is operated by the Corps of Engineers. The power generated is marketed by the Bureau of Reclamation. During fiscal year 1946 contracts for the sale of power to the following organizations were executed: Valley County Electric Cooperative near Whatley, Mont., 450 kilowatts; Mid-Yellowstone Electric Cooperative near Forsythe, Mont., 335 kilowatts; Montana-Dakota Utilities Co. for delivery of approximately 55 kilowatts, near Frazer and Oswego, Mont. A memorandum of understanding was executed with the Office of Indian Affairs for the use of certain transmission facilities under its jurisdiction and for delivery to the Indian Office of power required for irrigation pumping and other uses.

During the fiscal year, the Fort Peck, Shoshone and Riverton projects generated 172,241,000 kilowatt-hours of which 100,900,000 kilowatt-hours were generated on the Fort Peck project.

Housing shortages.—Housing shortages have been very severe throughout the region. Some Quonset huts and trailer houses have been obtained and put to use. Some construction buildings at a chrome mine have been obtained and dismantled and the material salvaged for use elsewhere. Four small housing units at the same mine have been obtained and plans have been made for dismantling them, moving them to regional headquarters, and reerecting them.

There has also been a serious shortage of many items of supplies and construction materials. In particular, construction work has been greatly retarded by lack of lumber and reinforcing steel.

Region 7

In region 7, comprising almost one-half of Wyoming, almost all of Nebraska, the north half of Kansas and that portion of Colorado east of the Continental Divide, 2 projects were in operation, 3 under construction, 7 under authorization and 25 in study status during the fiscal year ended June 30, 1946.

Following VJ-day, construction was greatly accelerated on the Colorado-Big Thompson project and during the year the 13.1-mile Alva B. Adams

Tunnel, under the Continental Divide, and Shadow Mountain Dam on the western slope of Colorado, were both completed. Work continued on the dikes for Granby Reservoir. In June, contracts totaling approximately \$16,000,000 were awarded for the construction of Granby Dam and Horsetooth Reservoir—both important links in the Colorado-Big Thompson project.

The concrete lining of the Adams Tunnel was completed in February. Construction work on Rams Horn and Prospect Mountain Tunnels is ahead of schedule and bids have been announced for penstocks and for construction of the Estes Park and Marys Lake power plants.

Highlight of the construction year was the ground-breaking ceremony held May 15 at Kortes Dam site, when the Morrison-Knudsen Co., Boise, Idaho, began work on their \$4,688,000 contract. Kortes Dam was the first unit of the entire Missouri Basin plan to reach construction stage.

The seven projects authorized but not yet under construction are all units of the Missouri Basin program and include: Frenchman-Cambridge unit, Nebraska, Bostwick unit, Nebraska-Kansas, Cedar Bluffs unit, Kansas, Kirwin unit, Kansas, Glendo unit, Wyoming, North Republican unit, Colorado-Kansas and the Wells unit, Kansas-Nebraska.

On the Frenchman-Cambridge unit the preconstruction work necessary for the preparation of final plans and specifications was completed on Enders Dam, Medicine Creek Dam, Cambridge Diversion Dam and the Cambridge-Oxford Canal.

On the Cedar Bluffs unit, foundation investigations were started on the Cedar Bluffs Dam.

On the Kirwin unit, preconstruction work necessary for the preparation for final plans and specifications for Kirwin Dam was completed.

Preconstruction work was begun on the Glendo Dam, Glendo unit, during the year as well.

River basin surveys.—During the year additional plans were developed for the Missouri River Basin as well as for the three major transmountain diversion projects.

All of the approved projects listed in Senate Document No. 191 have been subjected to further study and analysis to develop the most meritorious plan before requesting authorization.

Investigation of the Niobrara River Basin in northern Nebraska was initiated during the year. This basin survey will develop a plan for maximum use of the surplus waters in the basin which will be in excess of 500,000 acre-feet annually. The annual precipitation varies from 16 to 22 inches annually and there is an urgent need for power development in this area.

Basic data for the preparation of a report have been compiled for the Blue River-South Platte and Gunnison-Arkansas projects in Colorado. Project development and construction costs on these two projects alone

will approach \$800,000,000. The proposed projects will irrigate over 1,000,000 acres of land and will produce over 4,500,000,000 kilowatt-hours of electrical energy annually—sufficient practically to revolutionize existing Mountain States industries and create many new ones.

Transmountain diversion projects in Wyoming also are under investigation. New sources of water for the irrigable areas in the Saratoga-Encampment area and in the valley of the Sweetwater and Laramie Rivers, are being sought. Authorization of these projects will not be sought until the Upper Basin States have agreed on allocation of Colorado River water.

Ground water investigations.—Investigations of ground water resources have gained impetus during the last year. A closely knit cooperative program has been developed with the United States Coast and Geodetic Survey covering ground water possibilities in all potential pumping areas, and including stream gaging, chemical analysis and sediment studies throughout the region. Ground water supplies are recognized as an important factor in the future prosperity of our irrigated areas. Subterranean storage, timed recharging for pump requirements to augment or supplement surface supplies and continuing records of water tables for future operations are important elements in this program.

During the year the Kendrick project reached the operations stage. The first irrigation water flowed through the Casper Canal to unit No. 1 (a distance of 62 miles), on June 20. It is expected that 3,500 acres of new land will be brought under irrigation during the present year and ultimately 35,000 acres will be irrigated. The principal crops to receive water this year will be alfalfa and small grain.

Water rental notices were issued on the Mirage Flats project, northeast Nebraska, and it is expected that about 5,000 acres will receive water during the 1946 irrigation season.

This year also witnessed the growth of region 7's power load. During the war the interconnected power system of Colorado-Nebraska and Wyoming served a number of war emergency loads but after VJ-day these, of course, fell off. By February 1946, power requirements of the system had exceeded those of the previous year, thereby wiping out all war-load losses.

REA cooperatives continued to receive electric energy from the Bureau particularly for irrigation pumping. In southeast Wyoming and northeast Colorado, crop production was greatly increased during the usual critical times.

Funds were approved by Congress during the year for the extension of the Bureau's transmission system into eastern Colorado where electrical energy will be made available for additional irrigation pumping and for an expansion of the productive area in that part of the State.

In the fiscal year just completed the four hydro-power plants of region 7 generated 235,700,000 kilowatt-hours of electricity, which is a 27 percent

increase over the previous year. Some 30,000,000 kilowatt-hours were purchased by region 7. There were 236,800,000 kilowatt-hours of energy sold to municipalities, REA cooperatives, industrial plants, army camps and public utilities for a gross revenue of \$1,582,000—also an increase of 27 percent over the previous year.

Organization

Although reorganization of the Bureau was set in motion in September 1943 to prepare for the vastly expanded activities foreseen with the war's end, many of the administrative improvements contemplated in the reorganization plans were necessarily suspended because of lack of staff and because many of the planned improvements were geared to and dependent upon the anticipated expansion of the Bureau's program. With Congress' complete endorsement in August 1945 of the reorganization plan, the cessation of hostilities was the signal for application of the long-held plans.

The plans placed into effect provided for the administrative consolidation of all field activities into seven regions. Operating policies and practices required complete reshaping so as to provide for the assumption of major administrative responsibilities by the seven regional offices. The Office of Management Planning was the administrative facility used to provide the necessary technical guidance and assistance in all phases of the wholesale reorganization.

Comprehensive Manual of Instructions

The termination of the war also enabled the Office of Management Planning to recruit promptly a small staff to guide and assist the branches and offices of the Bureau in the preparation of a long-needed comprehensive manual of rules, regulations, and operating procedures. Such a manual was foreseen as especially necessary to facilitate the indoctrination and training of a greatly expanded Bureau staff. Several of the handbooks of the manual system were completed during the fiscal year, and the schedule calls for completion of the balance of the handbooks early in fiscal year 1947. The manual is designed to set forth the legislative enactments governing the Bureau's program, Department and Bureau policies, and administrative procedures for the effective and efficient performance of the Bureau's responsibilities. In addition, the handbooks of the manual will set forth the standards and requirements of the Bureau's highly technical undertakings in the fields of engineering, economics, water utilization and electric power generation and transmission.

Administrative Examinations

During the fiscal year the administrative examiners of the Office of Management Planning completed administrative surveys of five of the Bureau's

seven regional offices. The administrative examinations completed have been very fruitful in bringing to the fore the administrative problems and requirements of the regions surveyed, thus facilitating the administrative action required to resolve existing problems and make provision for administrative requirements developing along with expanded program activities.

Decentralization and Consolidations

Search for improved administrative efficiency and effectiveness lead to studies of needs for decentralization of authority and responsibility and for consolidation of duplicated phases in related field activities. These studies resulted in consolidation of project and other field activities in homogenous geographical areas where such consolidations result in more economical and effective performance of Bureau work and enable further decentralization of authority and responsibility. The facility for effecting such consolidations and providing for further delegations of authority and responsibility is termed a district organization. District organizations were established during the fiscal year in regions 1, 2, 3, and 7.

Establishment of Uniform Regional Staffs

Establishment of uniform staffs for the regional offices in order to facilitate the performance of regional office responsibilities and the exercise of necessary controls by the Commissioner came about during the fiscal year. A major part of this establishment was the preparation of standard job descriptions for the authorized positions.

Program and Progress Charting

To direct the scheduling of work programs, operate controls, and institute reporting procedures for measurement and evaluation of progress, an Office of Progress Control has been established this year. The new office provides current reports on work progress and on any conditions delaying scheduled performance. By directing the attention of the staff offices to the reported needs of the field offices, the office aids in coordinating and facilitating the work of the Bureau. In administering procedures for scheduling and reporting, the Chief Progress Control Officer exercises functional direction over all the progress control units in the regional offices.

Shortly after the office was established and before it was fully staffed, it was faced with the problem of obtaining work schedules for the second half of the fiscal year for the enlarged program of work made possible by the funds appropriated by the First Deficiency Act of 1946. In accordance with procedures outlined by the Office of Progress Control, the proj-

ect work programs were proposed by the regional directors, reviewed and coordinated by the staff officers, approved by the Commissioner, and issued as the Commissioner's Program, January-June 1946. This advance planning has been invaluable in promoting expeditious and efficient accomplishment of all phases of the Bureau's work connected with the construction program. To assure timely achievement of long-range objectives, all basic project programs are being revised, taking into consideration the results of the January-June work program just completed and the funds appropriated for fiscal year 1947. When the revised basic programs are approved, the detailed work schedules for each operating office during 1947 will be developed.

The operation of progress control is a new function for the Bureau. As emphasis was placed first upon work, scheduling progress reporting procedures have had to be geared directly to the work schedules as they were established. A reporting procedure has been instituted to indicate periodically the status of performance on the construction program as well as the outlook for future accomplishment. The outlook report enables the various offices to adjust their operations to the coming work load. A status report of progress on the Bureau programs has been developed and four issues have been prepared measuring accomplishment in comparison with the amount of work scheduled. This report currently covers the programs of construction, project planning, and personnel recruitment and indicates the status of funds, invitations issued, awards of contracts, and the procurement of supplies. Detailed narrative reports of regional office activities are summarized and matters requiring attention are referred to the offices concerned.

Field Procedures Survey

Study was made during the year of the field reporting procedures and a survey was conducted to determine upon a system that would contribute the maximum information with the least burden upon the operating field offices. The reporting procedures will be coordinated with the developments in work scheduling and programming, and expanded to measure periodic progress on the basis of physical completion, cost, and time. Accurate and comprehensive progress reporting and analysis becomes increasingly important as the work of the Bureau increases in volume and in scope.

Financial Operation and Control

At the end of the 1946 fiscal year the total investment of the Federal Government in projects constructed by the Bureau of Reclamation amounted to \$993,056,468, an increase of \$40,162,926 over the previous year.

TABLE 5.—Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions

State and project	Construction cost		Operation and maintenance before publication notice (net)		Operation and maintenance deficits, arrearages, and penalties		Construction revenues, contributed funds, and nonreimbursable appropriations (contra)		Abandoned works, non-reimbursable cost and charge-offs	Net balance	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946		Fiscal year 1946	To June 30, 1946
Arizona:											
Gila Salt River	\$856,755.76	\$8,564,910.63	\$15,092.74	\$22,411.24			\$218,351.70	\$311,287.30		\$1,060,014.72	\$8,843,705.69
Yuma Auxiliary		20,244,688.48		115,993.50				3,200,814.81			17,644,343.78
Yuma Auxiliary		9,020,060.50						2,251.00		1,112.13	9,020,300.80
California:											
Central Valley		9,373,406.10		388,934.62				301,498.00		12,871.93	9,671,276.71
Orland	4,204,940.71	163,186,067.00	129,082.69	40,368.78			13,638.16	305,213.13		4,162,228.96	162,861,222.65
Colorado:											
Colorado-Big Thompson		2,448,669.71		111,432.99			233.38	28,414.77		233.38	2,471,466.58
Frutiger Reservoir	4,897,387.37	26,387,750.83									
Grand Valley		200,740.71									
Panama	60.32	5,095,621.96		138,621.28			954,603.65	1,112,102.01		3,942,783.72	25,275,648.82
Pine River	178.15	56,681.30					4,529.40	2,500.00		16,164.03	4,150,460.84
San Luis Valley	1,908.04	3,329,632.28		1,695.72				2,319.77		1,986.04	3,331,427.67
Uncompahgre	79,465.81	310,315.45					2,510.44			79,465.81	310,315.45
Idaho:											
Boise		8,976,443.18		311,103.02			196,368.80	25,601.42		13,319.46	8,106,367.30
Boise-Anderson Ranch		16,035,747.35		422,283.48			903,699.42	1,348,651.53		1,54,090.93	15,920,684.88
Boise-Payette	5,479,431.06	15,611,216.10					4,636.19	13,998.37		5,474,704.87	15,597,217.73
King Hill	99,700.61	4,930,502.20		11,589.77			734.55	3,614.53		88,488.87	4,938,477.44
Maldoka	1,905.36	1,905,918.80					110,122.51	28,187.27		1,987,854.04	
Pellissier		22,717,999.24		315,719.59			644,440.26	2,207,869.91		1,41,431.27	21,468,001.03
Montana:											
Kansas: Garden City	186,793.56	342,063.68		52,868.10				42,957.05		186,798.56	217,063.84
Montana:											
Bitter Root		947,641.05						61,356.82			
Frenchtown		273,603.11		5,496.26			516,637.95				
Hungry Horse	161,571.66	1,559,590.46									
Humbug		1,559,590.46		11,000.16			8,604.57	35,441.58		161,571.66	1,662,571.66
Milk River	35.76	8,673,406.82		436,505.82			391,057.46	124,261.96		18,604.57	1,862,166.35
San River	104,781.46	9,751,509.35		133,102.38			101,052.03	48,555.64		1,490.31	7,350,743.46
Montana-North Dakota: Lower Yellowstone		3,685,433.14		11,697.42			103,137.65			104,781.46	9,849,543.17
Yellowstone		19,551,148.27		743,294.42			922,893.29	130,719.25		12,695.96	4,093,655.76
Nebraska-Wyoming: North Platte							1,516,486.08	851,393.84		1,551.01	20,930,534.93

[illegible]

See footnotes at end of table, p. 115.

TABLE 5.—Consolidated statement by projects of construction cost of irrigation and power works, other items reimbursable with construction, and deductions—Con.

WATER CONSERVATION AND UTILITY PROJECTS

State and project	Construction cost		Operation and maintenance during construction		Construction revenues ¹		Net construction cost	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946
Colorado: Mancos.		\$748,325.50						\$748,325.50
Idaho:								
Mann Creek		32,836.75						32,569.28
Rathdrum Prairie		349,313.78						350,201.09
Montana:								
Bitterroot	\$169,272.91	227,111.12	\$892.31		\$2.00	\$267.47	\$169,272.91	
Buffalo Rapids, first division		86,580.83				5.00	228,005.43	
Buffalo Rapids, second division		2,004,261.40						86,580.83
Intake		5,239.83						2,043,392.14
Milk River, Dodson		109,573.30				665.07		1,472,022.99
Missoula Valley		62,497.81						1,472,022.99
Saco Divide		41,687.79						69,417.12
Nebraska: Mirage Flats		43,764.58						45,764.99
North Dakota: Buford-Trenton		114,797.85						114,797.85
South Dakota:								
Angostura		2,447.97						2,447.97
Rapid Valley		1,010,677.85						2,447.97
Texas: Balmorhea		2,569,217.60						2,565,756.60
Utah:		946,888.84						945,888.84
Newton		43,484.62						43,484.62
Scofield		701,693.86						759,991.41
Wyoming: Eden		29,821.05						29,821.05
Total	2,459,933.10	10,975,313.11	15,729.91	70,767.40	1,915.84	3,134.98	2,476,578.85	11,042,945.53

SPECIAL PROJECTS

State and project	Construction cost		Contributions		Net balance	
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946
Colorado River Dam fund:						
All-American Canal.....	\$3,960,840.29	\$36,193,804.53	\$20,000.00	\$20,000.00	\$3,940,840.29	\$36,173,804.53
Boulder Canyon.....	1,771,192.39	144,158,097.08	70,149.97	70,149.97	1,701,042.42	144,088,547.71
Arizona:						
Davis Dam.....	2,407,265.04	5,907,120.81			2,407,265.04	5,907,120.81
Parker Dam.....		6,821,853.10				
Parker Power.....	332,457.99	15,520,645.34			332,457.99	15,520,645.34
Montana: Fort Peck.....	165,857.71	810,607.63			165,857.71	810,607.63
Texas: Colorado River.....	124,242.93	23,869,183.17			114,662.18	23,859,602.42
Washington: Columbia Basin.....	5,069,016.83	189,694,795.86	5,580.75	9,580.75	112,641.40	184,513,137.63
Total.....	13,830,873.18	422,976,708.12	5,281,388.95	12,103,242.05	8,549,484.23	410,873,466.07
Grand total.....	40,162,926.06	993,056,468.20				

¹ Contra.² Includes \$1,164.35 authorized charge-offs applicable to fiscal year 1946.

Operations of Reclamation Fund

During its 44 years of operation accretions to the Reclamation fund have totaled \$233,480,443. These have come from the sale of public lands, proceeds from the Oil Leasing Act, from Federal water power licenses, potassium royalties and rentals, and receipts from naval petroleum reserves from 1920 to 1930 under the act of May 9, 1938.

TABLE 6.—*Accretions to Reclamation fund by States*

State	Sale of public lands		Proceeds from Oil Leasing Act		Total to June 30, 1946
	Fiscal year 1946	To June 30, 1946	Fiscal year 1946	To June 30, 1946	
Alabama.....			\$659.24	\$198,295.02	\$198,295.02
Arizona.....	\$11,243.39	\$2,777,582.75	2,833.69	12,128.16	2,789,710.91
Arkansas.....				886.47	886.47
California.....	30,133.18	8,334,200.72	1,539,779.07	26,526,608.23	34,860,808.95
Colorado.....	8,168.63	10,334,498.83	320,693.64	1,764,465.29	12,098,964.12
Florida.....			10.50	10.50	10.50
Idaho.....	5,891.43	7,063,989.01	328.31	23,230.15	7,087,219.16
Kansas.....	965.72	1,034,567.12	5,873.55	56,541.49	1,091,108.61
Louisiana.....			7,424.35	363,056.43	363,056.43
Michigan.....			1,902.11	4,292.46	4,292.46
Mississippi.....			113.66	345.97	345.97
Montana.....	9,288.97	15,397,913.87	269,221.14	2,631,783.38	18,029,697.25
Nebraska.....	2,109.14	2,099,807.84		446.25	2,100,254.09
Nevada.....	2,177.46	1,044,523.86	5,132.26	29,493.27	1,074,016.63
New Mexico.....	17,652.46	6,760,462.76	758,317.83	6,668,312.70	13,428,775.46
North Dakota.....	470.86	12,220,117.13	16,119.86	319,616.31	12,539,733.44
Oklahoma.....	882.32	5,932,027.90	3,117.14	16,298.30	5,948,326.20
Oregon.....	2,834.24	11,998,158.97	1,420.53	3,370.57	12,001,529.54
South Dakota.....	925.55	7,734,601.03	3,142.28	33,245.55	7,767,846.58
Utah.....	3,375.44	4,400,914.92	145,680.92	1,637,359.64	6,038,274.56
Washington.....	5,904.61	7,481,006.83	1,840.87	47,956.95	7,528,963.78
Wyoming.....	15,836.67	8,737,917.22	1,714,713.59	46,465,757.32	55,193,674.54
Total.....	117,860.07	113,352,290.26	4,798,324.54	86,793,500.41	200,145,790.67
Proceeds, Federal water power licenses.....					1,031,757.60
Proceeds, potassium royalties and rentals.....					2,522,872.24
Receipts from naval petroleum reserves, 1920-38, act of May 9, 1938.....					29,778,300.23
Proceeds from right-of-way over withdrawn lands, act of July 19, 1919.....					1,722.64
Grand total.....					233,480,443.38

¹ Proceeds for fiscal year, \$34,944.75.

² Proceeds for fiscal year, \$420,677.90.

Collections.—Construction and operation, and maintenance repayments, water rentals, power revenues, etc., have totaled \$195,484,979.

Disbursements during that period have totaled \$381,070,315, leaving a balance in the fund on June 30, 1946, of \$47,895,107. Repayments of construction charges to the Reclamation fund during the fiscal year 1946 totaled \$2,951,839. Operation and maintenance collections totaled \$1,653,809, of which \$397,957 accrued to the Reclamation fund. Receipts from water rentals, power sales, and other sources aggregated \$18,938,730, more than twice the receipts for the previous fiscal year.

Decentralization of Accounting

During the fiscal year the Director of Finance authorized a study of the Bureau of Reclamation accounting system and procedure with a view of streamlining the accounting and developing procedure for current reporting. At the close of this fiscal year an improved plan of control has been devised, and the entire accounting is being decentralized into regional offices, with cash control being maintained in the Washington office. The plan of decentralization of the accounting should result in a more effective control and current reporting for all projects within each region. This plan will also facilitate the preparation of consolidated reports on a monthly basis, so that the financial position will be currently available for individual projects as well as the over-all operations of the Bureau.

Reclamation Legislation

With the close of the fiscal year 1946, proposed legislation of far-reaching significance to Reclamation was pending before the Seventy-ninth Congress. Proposed legislation included House bills 520 and 5124. House bill 520 would "facilitate settlement of returning veterans on farms in projects constructed, operated, and maintained by the Bureau of Reclamation." Extensive hearings were held by the House Committee on Irrigation and Reclamation on House bill 5124, a bill "Relating to the sale of electric power and power privileges under the Reclamation Project Act of 1939." Former Secretary Ickes recommended enactment of the bill with certain amendments. One of the amendments would authorize the Secretary of the Interior, whenever opportunities arise in connection with Federal reclamation projects, to improve conditions for fish and wildlife and to provide recreational facilities on a nonreimbursable basis. The Solicitor of the Department, the Commissioner of Reclamation, the Director of the Fish and Wildlife Service, and the Associate Director of the National Park Service appeared before the Committee.

The act of July 14, 1945 (Public Law 143, 79th Cong., 1st sess.), authorized the Secretary of the Interior to execute a contract between the United States and the Truckee-Carson irrigation district. This contract authorized the payment of the deficit of the district from funds received from water rights sold after January 1, 1942.

An amendment (act of Mar. 6, 1946, 60 Stat. 36) to section 9 of the Boulder Canyon Project Act (45 Stat. 1057) renewed and extended to veterans of World War I, the Spanish-American War, and veterans of the insurrection in the Philippines, the veterans' preference in connection with the opening of public lands to homestead entry on lands watered from the Gila Canal in Arizona and the All-American Canal in California. The act also extended the same preference to veterans of World War II.

The act of June 25, 1946 (Public Law 440, 79th Cong., 2d sess.), amended the act of September 27, 1944 (58 Stat. 747), entitled "An act to allow credit in connection with certain homestead entries for military or naval service rendered during World War II." This amendment extended the benefits of the original act to persons under the age of 21 years who were otherwise qualified.

President Truman signed the War Department Civil Functions Appropriation Act, 1947, on May 2, 1946. On May 3, he issued a statement saying he was "glad to note that the Congress, by the addition of certain provisos to the item for the Kings River project, California, has afforded an opportunity for reassuring that the Federal Reclamation policy, including repayment and the wide distribution of benefits, will apply to that project." The President further added that in the near future he planned to send to the Congress his recommendations regarding an over-all plan for the development of the water resources of the Central Valley area in California. In the meantime, President Truman instructed the Director of the Budget to impound the funds appropriated for the construction of the Kings River project, California, pending determination of the allocation of costs and the making of the necessary repayment arrangements.

The Congress approved an interstate compact between the States of Colorado and New Mexico with respect to the waters of the Costilla Creek (act of June 11, 1946, Public Law 408, 79th Cong., 2d sess.).

Public Law 439, Seventy-ninth Congress, second session, authorized the Secretary of the Interior to convey approximately 10 acres of land, heretofore withdrawn for reclamation purposes, to the Boulder City Cemetery Association for use as a cemetery.

Squatters on the public lands within the boundaries of the Anderson Ranch Reservoir site, Boise project, Idaho, will receive equitable relief under the act of June 26, 1944 (Public Law 450, 79th Cong., 2d sess.).

The Bureau of Reclamation's authority on the Colorado River was broadened by the act of June 28, 1946 (Public Law 469, 79th Cong., 2d sess.).

Personnel Recruitment and Training

Appointing authority to the Bureau of Reclamation was increased by the Secretary during the year just ended until it now includes all positions in the field service in grades CAF-13 and P-6 and below, with the exception of policy making and major supervisory positions. All this appointing authority was delegated by the Commissioner to the Chief Personnel Officer and, with certain limitations, to the regional offices.

During the past year, several new personnel services were initiated, including Bureau-wide standard employment practices and the launching of labor relations and safety programs. As these additional functions became organized, the appointing authority of the regions was increased to include

CAF-11 and P-4. By this action, approximately 95 percent of the personnel matters can be handled conclusively at their source, resulting in more rapid and efficient management of personnel.

The Office of the Chief Personnel Officer was charged with the responsibility of anticipating the personnel needs to meet the post-war programming of the Bureau. The number of Reclamation employees increased from 7,033 on June 30, 1945, to 14,362, June 30, 1946.

Veterans Fill New Positions

In collaboration with the Personnel Supervision and Management Division of the Office of the Secretary, plans were made effectively to administer the Veterans Preference Act of 1944. By the end of the fiscal year, with the rapid demobilization of the armed forces, practically all positions were being filled by veterans.

At the close of the fiscal year the Personnel Office was proceeding with the heavy responsibility of developing a staff of personnel to meet an unprecedented Reclamation program. Plans were outlined to employ several thousand technical and specialized engineers in the fields of hydrology, structural, mechanical, electrical, and civil engineering. Also being selected are economists, project planners, superintendents, and inspectors. Administrators capable of coordinating the planning and organization of such a program were recruited primarily by promotion from the nucleus staff maintained by the Bureau throughout the war and from former personnel returned from military service.

Employee Development Plans

Many long-range, practical training programs for Bureau employees have been initiated. The Guide to Employee Training, a handbook for new employees, has been published and is in use throughout the Bureau. Specialized needs of the Bureau required the undertaking of training to provide qualified chief clerks, concrete inspectors, and materials inspectors, and other types of employees. Training for disabled veterans has been authorized in an on-the-job basis within the Bureau, as well as job training for those employees eligible for benefits under the GI bill. Arrangements, on a cooperative basis between interested colleges and the Bureau, have been put into effect for employees to pursue a work-study plan. All of these plans are designed to attract and build a more productive staff.

During the past year there has been established in the Office of the Chief Personnel Officer a Central Board of United States Civil Service Examiners for the Bureau of Reclamation. As a central examining medium, this board operates within its stipulated function as a single agency for the purpose of serving the entire field service of the Bureau. The board has the responsibility for holding examinations, establishing registers, and

certifying employees to positions in the field service of the Bureau. This function is executed in those specialized or technical fields peculiar to the agency, particularly for those which recruitment is to be made and registers established on a Nation-wide basis.

The Branches of Project Planning and Power Utilization and the Offices of Personnel and Finance were transferred to Washington during the fiscal year.

Personnel Changes

Notable among changes in the Bureau's top ranking personnel during the past year was the appointment of Michael W. Straus as Commissioner to succeed Harry W. Bashore, who retired after 39 years of service in the Bureau. Other important changes were the appointment of Richard L. Boke as Regional Director of region 2, Sacramento, Calif., to succeed Charles W. Carey, deceased, and the promotion of Assistant Regional Director R. J. Newell, region 1, Boise, Idaho, to fill the vacancy of Regional Director created by the transfer of Frank A. Banks to the Columbia Basin project as supervising engineer.

International Cooperation

In the interest of scientific and cultural cooperation the Bureau has made available design and construction methods to many foreign governments through technical papers, by visits of foreign engineers and technicians to Bureau projects and offices and through facilities of the Bureau training program. During the past year 219 requests for technical literature were received and 194 engineers and technicians from 29 foreign countries made 362 visits to the design and construction offices and projects. Of this number 35 engineers took extensive training in the design and construction offices and 20 of these completed a full year's work.

William L. Newmeyer, Chief of the Bureau's Resources and Development Division, was sent to Greece as a member of a special mission of the United Nations Food and Agricultural Organization to make a comprehensive study of the resources development possibilities and make a report for a program of reconstruction and economic development there.

In addition to this interest in the Bureau's technical accomplishments, representatives of foreign governments have displayed great interest in the Bureau's organization structure and administrative techniques. Organizational and administrative information have been provided for virtually all foreign governments concerned with irrigation and hydroelectric power developments.

Division of Power

ARTHUR GOLDSCHMIDT, *Director*



THE Division of Power has the responsibility of supervising and promoting the efficient coordination of the power activities of the Department which include the Bonneville Power Administration, the Bureau of Reclamation, the Southwestern Power Administration, the Office of Indian Affairs, and the National Park Service. The shift in emphasis from the production of war materials and munitions to peacetime production has brought about an increasing number of complex problems and this has added materially to the work of the Division. Power from federally constructed projects which had formerly played such an important part in the prosecution of the successful war against the Axis Nations was suddenly made available for peacetime purposes. The marketing of this power in accordance with the public power policy as declared by the Congress has been of major concern to the Division.

The work load of the Division was further augmented in view of the additional responsibilities which were placed upon the Secretary by the Flood Control Act of 1944 and the River and Harbor Act of 1945. The Secretary has the responsibility of transmitting and marketing all excess power generated at reservoir projects constructed by the Corps of Engineers of the War Department. As of June 30, 1946, the ultimate installed capacity of these authorized projects is to be more than 7,200,000 kilowatts. In addition, the installed capacity of projects authorized to be constructed by the Bureau of Reclamation is to be 1,408,400 kilowatts, making a grand total of ultimate capacity of projects thus far authorized of 8,608,400 kilowatts. This is in addition to the presently installed capacity of 3,107,300 kilowatts at projects from which the Department is now marketing the power. At the present time the Department is operating and marketing power from the largest aggregate of hydroelectric power in the world. This includes power generated at dams operated by the United States Army Corps of Engineers.

The responsibility of the Department of the Interior in the disposal of power is one of great magnitude. During the 1946 fiscal year 15 billion kilowatt-hours of saleable energy were delivered by the generating plants from which the Department marketed the power, as compared to 18 billion kilowatt-hours during the preceding fiscal year.

Marketing studies.—It was anticipated that upon the cessation of hostilities there would be a decided drop in the use of electrical energy due to the closing of the many war plants as vast quantities were used in the production of aluminum, magnesium, and other light metals. However, generally the loads are holding up exceptionally well. The shutting down of the aluminum plants did curtail the use of power marketed by the Bonneville Power Administration and the Southwestern Power Administration, but arrangements are now being made to put some of these plants back into operation on a peacetime basis when they will again require even larger amounts of electrical energy.

Studies are going forward as rapidly as possible in order to ascertain how best the electrical energy from authorized flood control and river and harbor projects, as well as from those now under construction, can be disposed of in compliance with the Federal power policy which is, in effect, that the benefits of this power shall not be monopolized by limited groups, but shall be so distributed as to enhance the domestic, agricultural and industrial phases of our national economy.

These studies are being made by the Bonneville Power Administration, the Bureau of Reclamation, and the Southwestern Power Administration in their respective areas of operation, and by the Division of Power for those projects outside of the above areas. In the Southeast for instance, the Division has given particular attention to six projects for which funds have been appropriated and which are now in process of construction. They will have an ultimate installed capacity of 1,057,000 kilowatts.

All of these studies are necessary to determine the most feasible method for making available to the people of the various areas the maximum benefits from these projects at a minimum cost. They involve the orderly river basin development, the scheduling of construction features, the reconversion of the war plants, the allocation of costs, and the planning of facilities necessary to market the power generated at the various projects.

If continued, the present high costs of construction, which are believed to be abnormal, would prevent the construction of many flood control, navigation and irrigation dams which are justified on a basis of monetary costs and benefits, and would increase the cost of incidental power in some cases to the point where the regions affected would be benefited very little. The Division's studies of construction costs show some postwar correlation with both volume and real national income per capita. They indicate that immediate postwar construction costs are likely to be higher than those in subsequent years, but that construction cost levels otherwise are not usually lowered unless both volume of private construction and real income drop for two successive years.

In order that there may be proper coordination of Federal functions and activities with respect to multiple-purpose river basin developments between the Federal agencies involved, a close working relationship is being developed with the Corps of Engineers of the War Department and with the

Federal Power Commission. This relationship has to do with scheduling of installations at power plants, size and characteristics of generating units, design of substations and controls, markets available, and determination of costs of projects for rate purposes. This work is carried on in part through subcommittees of the Inter-Agency River Basin Committee which consists of representatives of the Federal Power Commission, the War Department, the Department of Agriculture, and the Department of the Interior.

In addition, the Division is working very closely with the Rural Electrification Administration in order that the benefits from these federally constructed developments may be made available to present and future rural consumers. At the present time 37 REA-financed projects are being supplied with power from these projects at rates ranging down to less than 3½ mills a kilowatt-hour. As construction materials become more plentiful, a marked increase in the amount of energy purchased by these cooperatives from the Federal projects will undoubtedly occur as a large number of additional REA projects will be under way as rapidly as materials become available.

Rates and rate schedules.—The Division reviewed a number of major rate studies during the past year. It actively participated in the over-all rate study made by the Bonneville Power Administration, as well as in the rate study which was included in the comprehensive report of the Southwestern Power Administration. It reviewed new rates proposed by the Bonneville Power Administration, such as rates for railroad electrification, secondary energy, and irrigation pumping. Reviews were also made of the proposed changes in the governing provisions of Bonneville's basic kilowatt-year rate.

Power contracts.—Due to the change from wartime to peacetime operations, a large number of contracts have been modified and many new ones proposed to service new industries, all of which of any importance policy-wise have been reviewed by the Division.

Grand River Dam project.—With the surrender of Japan in August 1945, steps were taken to arrange for a return to the Grand River Dam authority, an agency of the State of Oklahoma, of the Grand River Dam project which had been taken over in 1941 by the Federal Government and, through the Southwestern Power Administration, was being operated for war purposes. Section 16 of the Federal Power Act provided a formula for a return of the project and a settlement of accounts arising out of its occupation and use by the Government. However, a satisfactory settlement under this provision would have been severely complicated by the fact that construction of the project by the authority had been financed entirely pursuant to an incompletely performed loan and grant agreement between the authority and the Government, that the Government had made extensive additions to the authority's properties, and that the authority's indebtedness to the Government needed refinancing. In these circumstances it was

felt by the authority and the Department of the Interior that a negotiated agreement under new legislation would afford the most practicable means for an equitable and speedy settlement of accounts and the establishment and maintenance of operations by the authority on a sound financial basis. Proposed legislation providing for such an agreement, drafted by the Division after consultation with the authority and interested Federal agencies, was passed by the House of Representatives and was pending before the Senate at the close of the fiscal year. Pending enactment of this legislation, the Division of Power directed and, to a considerable extent, participated in negotiations between the authority and the Southwestern Power Administration which resulted in a tentative agreement on all matters involved. Execution and performance of the agreement could be effected within a short time after enactment of enabling legislation.

Miscellaneous.—The Division cooperated in further studies and negotiations of the Bureau of Reclamation for the proposed acquisition of the rights of the Salt River Valley Water Users' Association in the power system of the Salt River project in Arizona, and made further studies of the proposal for acquiring the rights of the Minidoka and Burley irrigation districts in the Minidoka power system in Idaho.

The Division also independently assisted and cooperated with the Bureau in its efforts to assist the Arizona Power Authority, created by the State Legislature in 1944, in making plans and arrangements for marketing Arizona's share of the power developed at Boulder, Parker, and Davis Dams on the Colorado River.

The Division worked with the Bonneville Power Administration in the preparation of its report to the Congress showing a complete pay-out of all the power costs at the Bonneville and Grand Coulee projects and of its transmission lines at the present basic \$17.50 rate per kilowatt.

The Division has worked with the Territorial Governments of Puerto Rico and of the Virgin Islands in connection with their power problems. Assistance was given to the Puerto Rico Water Resources Authority in negotiating a 5-year lease with the Navy for the naval power plant at Roosevelt Roads and in negotiating the purchase of a 30,000 kilowatt floating power plant, declared surplus by the Army and sold to the Authority by the War Assets Corporation, for \$2,500,000. The authority was also aided in securing other surplus power equipment.

At the request of the Governor of the Virgin Islands, special studies were undertaken and recommendations made for the modernization of the inadequate and antiquated direct current systems of the islands of St. Thomas and St. Croix which were constructed when the islands were under Danish rule. As a result of these recommendations, legislation has been enacted and appropriations made by the Territorial Councils providing for the construction of modern alternating current systems.

A preliminary survey of the hydroelectric power possibilities in Alaska was initiated by the Division.

Bonneville Power Administration

PAUL J. RAVER, *Administrator*



THE year ending June 30, 1946, brought numerous unusual developments for the Bonneville Power Administration. With the cessation of hostilities and the consequent shutting down of many war industries, there was every reason to expect a drastic cut-back in power use. Indeed, the closing of the light metals plants in the Pacific Northwest did cancel more than 425,000 kilowatts. Plans in the earlier part of the year had been based on the possibility of a power surplus of some magnitude, and every measure was taken for finding or creating other outlets for the relinquished war load.

The surplus did materialize on the scale expected but was of very short duration. A sudden and decided upswing in the loads of retail distributors, due to increased consumer demand, occurred almost immediately following the close of the war. A great part of the war load came back to the Administration sooner than had been expected, both in various war-born industries and particularly in the resumption of the use of large blocks of power for aluminum production in Government plants leased to private industrialists.

The outcome of this unexpected reversal was that by the end of the fiscal year the Administration found itself with its surplus practically all contracted for and with a threatened shortage of power impending for a number of years in the future.

Revenues

Shut-down of war industries with the resultant cut-backs in the demand for power during fiscal year 1946 brought a temporary decline of Bonneville Power Administration revenues during the early part of the year. Revenues for sales of Bonneville and Grand Coulee power during the year were \$19,882,785, a decrease of 13½ percent from the peak reached in the preceding year. However, the latter part of 1946 showed sharp recovery in revenues, as power demands of distribution agencies and industries increased to the point where a definite shortage of supply threatened.

As will be seen in table 1, revenues by class of customer, the principal decrease in income was in the aluminum industry. But the reductions are reflected in most other categories of customers since the Administration had been supplying a large part of the war-industry load in the region.

TABLE 1.—*Revenue by class of customer, fiscal years 1939–46*

Class of customer	1940 and prior	1941	1942	1943
Industry:				
Aluminum.....		\$1,075,809	\$3,770,767	\$7,514,122
Other industry.....	\$275	12,899	243,726	1,284,588
Military establishments.....		254	11,860	182,156
Publicly owned utilities.....	12,347	119,659	411,146	1,230,740
Privately owned utilities.....	413,922	686,882	882,820	1,767,806
Other electric revenue.....		120	27,692	41,646
Total operating revenue.....	426,544	1,895,623	5,348,011	12,021,118

Class of customer	1944	1945	1946	Total to June 30, 1946	1946 per- centage (dollars revenue)
Industry:					
Aluminum.....	\$11,989,735	\$11,838,156	\$7,987,226	\$44,175,815	40.17
Other industry.....	2,976,947	3,780,727	2,810,662	11,109,824	14.14
Military establishments.....	472,789	390,742	298,087	1,355,888	1.50
Publicly owned utilities.....	1,994,750	2,141,635	1,711,822	7,622,099	8.61
Privately owned utilities.....	3,401,042	4,752,021	5,207,844	17,112,397	26.19
Other electric revenue.....	60,665	86,737	1,867,144	2,084,004	9.39
Total operating revenue.....	20,895,928	22,990,018	19,882,785	83,460,027	100.00

¹ This includes \$1,789,443 of contract cancellations applicable to fiscal year 1946. (The total of \$3,802,415 is apportioned over a period of 12 months.)

Total revenues for all operations from 1939 to June 30, 1946, were \$83,460,027. As of that date the Administration had collected and deposited in the United States Treasury power revenue receipts totaling \$78,164,232, and general fund receipts of \$1,070,845. Accounts receivable, excluding \$2,012,972 for unamortized cancellation charges, accrued unbilled revenues, unbilled exchange power sales, miscellaneous adjustments, and minor items account for the difference between total revenues and total receipts deposited with the United States Treasury.

Energy Production

The dams at Bonneville and Grand Coulee produced a total of 6,236,163,280 kilowatt-hours during fiscal year 1946. Energy deliveries to customers by the Administration were 6.9 percent less than this, a difference accounted for by transmission system losses. Table 2, generation at Bonneville and Grand Coulee Dams, shows the energy production from 1938 to the present, while table 3, electric energy account, gives in detail the explanation of energy received and energy delivered by the Administration.

TABLE 2.—*Bonneville Power Administration generation at Bonneville and Grand Coulee plants, 1938–46*

Fiscal years ending June 30	Bonneville Dam generation	Grand Coulee Dam generation	Total generation for BPA
	<i>Kilowatt-hours</i>	<i>Kilowatt-hours</i>	<i>Kilowatt-hours</i>
1939.....	34, 874, 138	.....	34, 874, 138
1940.....	208, 426, 077	.....	208, 426, 077
1941.....	894, 177, 000	7, 455, 000	901, 632, 000
1942.....	1, 807, 309, 000	741, 844, 249	2, 549, 153, 249
1943.....	2, 801, 480, 400	2, 816, 955, 729	5, 618, 436, 129
1944.....	3, 488, 873, 992	5, 750, 949, 460	9, 239, 823, 452
1945.....	3, 391, 127, 400	5, 660, 445, 960	9, 051, 573, 360
1946.....	2, 674, 834, 000	3, 561, 329, 280	6, 236, 163, 280
Total.....	15, 301, 102, 007	18, 538, 979, 678	33, 840, 081, 685

TABLE 3.—*Bonneville Power Administration electric energy account, fiscal year ending June 30, 1946*

Energy received—(kilowatt-hour):

Energy generated for Bonneville Power Administration:

Bonneville.....	2, 674, 834, 000
Grand Coulee.....	3, 561, 329, 280

Total.....	6, 236, 163, 280
Power purchased and interchanged in.....	291, 092, 650

Total received.....	6, 527, 255, 930
---------------------	------------------

Energy delivered—(kilowatt-hour):

Sales.....	5, 831, 146, 509
Power interchanged out.....	234, 928, 976
Used by administration.....	12, 659, 567

Total delivered.....	6, 078, 735, 052
----------------------	------------------

Energy losses.....	448, 520, 878
--------------------	---------------

Percent of total energy received.....	6.9
---------------------------------------	-----

Maximum demand on Bonneville and Grand Coulee plants (kilowatt), Aug. 28, 1945, 11–12 a. m.....	1, 346, 000
---	-------------

Load factor—total generated for Bonneville Power Administration.....	52.9
--	------

The installed capacity at the Bonneville and Grand Coulee plants suffered a reduction of about 150,000 kilowatts during fiscal year 1946 by the removal of two generators originally built for Shasta Dam which had been installed at Grand Coulee during the period of pressing war demand to meet the requirements of industrial and military establishments in this region. The total installed capacity at the two Columbia River dams is now 1,176,400 kilowatts. The accompanying graph shows the development of installed generator capacity (name plate rating) at the Bonneville and Grand Coulee plants for the fiscal years 1938 through 1946.

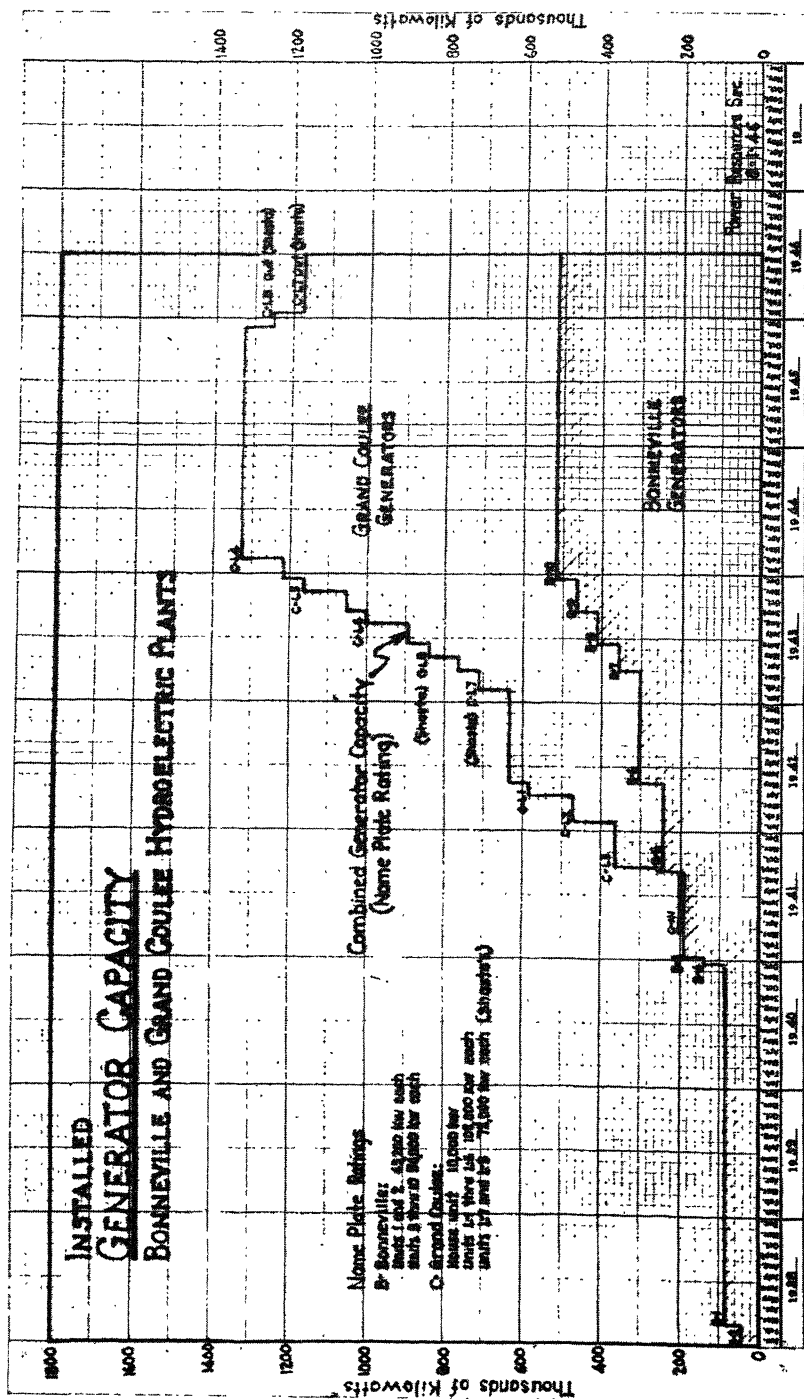


FIGURE 1.

The installed capacity of all the major power systems now serving the load areas of Oregon, Washington, Idaho, Montana, and Utah is 3,134,000 kilowatts, of which 2,785,000 kilowatts is hydroelectric. The balance, 349,000 kilowatts, is steam-electric capacity of which 101,000 kilowatts is high cost generation. Operating utilities of the Northwest are interconnected by system transmission facilities with the Bonneville Power Administration system, which forms the backbone of the Pacific Northwest's power pool.

The combined output of the major publicly owned systems—the Bonneville-Grand Coulee, Tacoma, and Seattle systems—was 7.8 billion kilowatt-hours in fiscal year 1946, which was 52 percent of the total generation of the combined power systems of the Northwest. The total combined generation of all utilities in the system during that year was just over 15 billion kilowatt-hours. Table 4 presents the actual generation in fiscal 1946 by the various electric systems of the Northwest interconnected systems.

TABLE 4.—*Actual generation by the electric utility systems of the Pacific Northwest—Northwest interconnected systems, fiscal year 1946*

Utilities	Billions of kilowatt-hours	Percent of total generation
Publicly owned:		
Bonneville Power Administration.....	6.2	41.1
Seattle City Light System.....	.9	6.0
Tacoma City Light System.....	.7	4.6
Total publicly owned.....	7.8	51.7
Privately owned:		
Puget Sound Power & Light Co.....	1.5	9.9
Washington-Pacific System.....	1.5	9.9
Northwestern Electric Co.....	.4	2.7
Portland General Electric Co.....	.5	3.3
Montana Power Co.....	2.1	13.9
Utah Power & Light Co.....	.5	3.3
Idaho Power Co.....	.8	5.3
Total privately owned.....	7.3	48.3
Total Northwest interconnected systems.....	15.1	100.0

By the end of the fiscal year the load of the Pacific Northwest was increasing so rapidly that during the coming winter season the available generating capacity is expected to be barely sufficient to carry the load. During the past 5 years the Bonneville Power Administration and the municipally owned utilities of Seattle and Tacoma have brought new generation into the area. These three systems now have a number of projects under construction which should help to relieve the growing power shortage. Seattle is increasing storage capacity at Ruby Reservoir which will increase the generation at its Diablo and Gorge plants. Tacoma has recently completed installations which have added 65,000 kilowatts of new capacity, and is in process of installing 25,000 kilowatts more.

TABLE 5.—General specifications—authorized and unauthorized projects

	Location	Proposed installation	Prime power	Pool elevation	Usable storage	Average head	Purpose
AUTHORIZED PROJECTS ¹							
1. Grand Coulee ¹	Washington	Kilowatts 1,944,000	Kilowatts 2 1,104,000	Feet 1,288.0	Acres-feet 5,200,000	Feet 321.0	Irrigation, power, storage, and navigation.
2. McNary	Oregon	828,000	2 465,900	340.0	-----	82.0	Navigation and power.
3. Foster Creek	Washington	1,024,000	2 610,500	937.5	-----	172.9	Power and irrigation.
4. Hungry Horse	Montana	1,142,000	125,600	3,517.0	3 1,500,000	442.0	Storage and power.
5. Lower Snake site No. 1	Washington	66,000	51,500	385.0	-----	45.0	Navigation and power.
6. Lower Snake site No. 2	do	112,000	86,300	400.0	-----	75.0	Do.
7. Lower Snake site No. 3	do	112,000	86,300	535.0	-----	75.0	Do.
8. Lower Snake site No. 4	do	74,000	57,400	585.0	-----	50.0	Do.
9. Lower Snake site No. 5	do	90,000	69,100	645.0	-----	60.0	Do.
10. Lower Snake site No. 6	do	104,000	80,400	715.0	-----	70.0	Do.
11. Garden Valley	Idaho	45,000	(*)	3,240.0	1,250,000	280.0	Irrigation and power.
12. Upper Seriver Creek	do	30,000	23,740	4,505.0	-----	390.0	Do.
13. Lower Seriver Creek	do	90,000	46,920	4,060.0	-----	770.0	Do.
14. Fallsades	do	30,000	14,950	-----	1,300,000	144.0	Flood control, irrigation, and power.
15. Detroit	Oregon	45,000	25,300	1,569.0	239,500	371.0	Flood control, navigation, and power.
UNAUTHORIZED PROJECTS ²							
1. The Dulles	do	829,400	2 456,600	100.0	-----	87.0	Navigation and power.

¹ 6 of ultimate 18 units are now in operation, 3 units are being manufactured and bids have been asked for 3 additional units.² Generation includes benefit from 1.5 million acre-feet of storage at Hungry Horse.³ Preliminary study; final usable storage will probably be in excess of this amount.⁴ Secondary power only.⁵ Should follow construction of Foster Creek project.

In the Bonneville-Grand Coulee system, Bonneville Dam is already complete. Three new units are under construction for installation at Grand Coulee Dam by the Bureau of Reclamation, and bids have been asked for three more such units. These will provide an important addition to the power supply available to the Bonneville Power Administration.

The only improvement under construction by a private utility is a 16,500 kilowatt development by the Idaho Power Co., scheduled for completion in December 1946.

Many projects will eventually be required for the full development of Columbia River potentialities and of Pacific Northwest resources. Table 5 lists the major authorized projects, plus the projected dam at The Dalles, on all of which construction is expected to start during the next few years, and whose output is essential to meet the growing Pacific Northwest loads.

The tentative installation schedule is as follows:

McNary: 3 units in 1952; 4 in 1953; 3 in 1954; and final 2 in 1955.

Foster Creek: 3 units in 1953; 4 in 1954; 2 each in 1955, 1956, 1957, 1958; and final one in 1959.

Detroit: One unit in 1951.

Lower Snake Plants: Development will begin in 1952 and be concluded in 1956.

The Dalles: (not authorized). Begin in 1956, and 11 units by 1959.

Grand Coulee: Unit No. 7 in November 1947; No. 8 and No. 9 in 1949; Nos. 10, 11, 12 in 1949; Nos. 13, 14, 15 in 1950.

Hungary Horse: Schedule and plans to be jointly determined by Bonneville Power Administration and Bureau of Reclamation.

The schedule has been arranged to meet the estimated growth of loads in the region but even strict adherence to it will not prevent a threatened shortage of power. Unwarranted delay in the development of essential projects can only result in dislocation of the normal economic growth of the Northwest with perhaps fatal effects to industrial developments, employment, population growth, and general well-being.

Energy Deliveries

Energy deliveries to customers for the fiscal year 1946 over the Administration's transmission system amounted to 5,831,147,000 kilowatt-hours. Total energy deliveries from the time the Administration's system first began to function are 31,810,204,000 kilowatt-hours. Table 6, electric energy sales by class of customer, shows the energy deliveries for the 8 years of the Administration's life.

TABLE 6.—*Electric energy sales by class of customer,¹ fiscal years 1939-45*

Class of customer	1939	1940	1941	1942	1943	1944	1945	1946	Total to June 30, 1946
Industry:	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>	<i>MWH</i>
Aluminum.....			522,982	1,845,249	3,588,848	5,453,893	4,667,381	2,538,590	18,616,943
Other industry.....		21	4,790	76,580	464,309	934,588	878,896	693,795	3,052,979
Military establishments.....			18	2,575	42,887	87,889	85,828	59,970	279,167
Publicly-owned utilities.....	7	3,101	32,134	142,491	435,289	727,642	823,817	635,284	2,799,765
Privately-owned utilities.....	30,036	188,806	317,713	357,704	739,076	1,467,804	2,057,203	1,903,508	7,061,350
Total.....	30,043	191,928	877,637	2,424,599	5,270,409	8,671,316	8,513,125	5,831,147	31,810,204

¹ Includes sales under exchange agreements.

The yearly system peak occurred on August 28, 1945, during the hour 11 a. m. to 12 noon, when the demand reached 1,346,000 kilowatts. This exceeded the rated generating capacity of 1,326,400 kilowatts by 1.5 per cent. The next highest peak came on August 31, 1945 from 9 a. m. to 10 a. m. with a demand of 1,312,000 kilowatts. These peaks occurred in August after the surrender of Japan but while industries were still operating on a wartime basis. In the following month aluminum production was curtailed and the demands on the Bonneville system became lower.

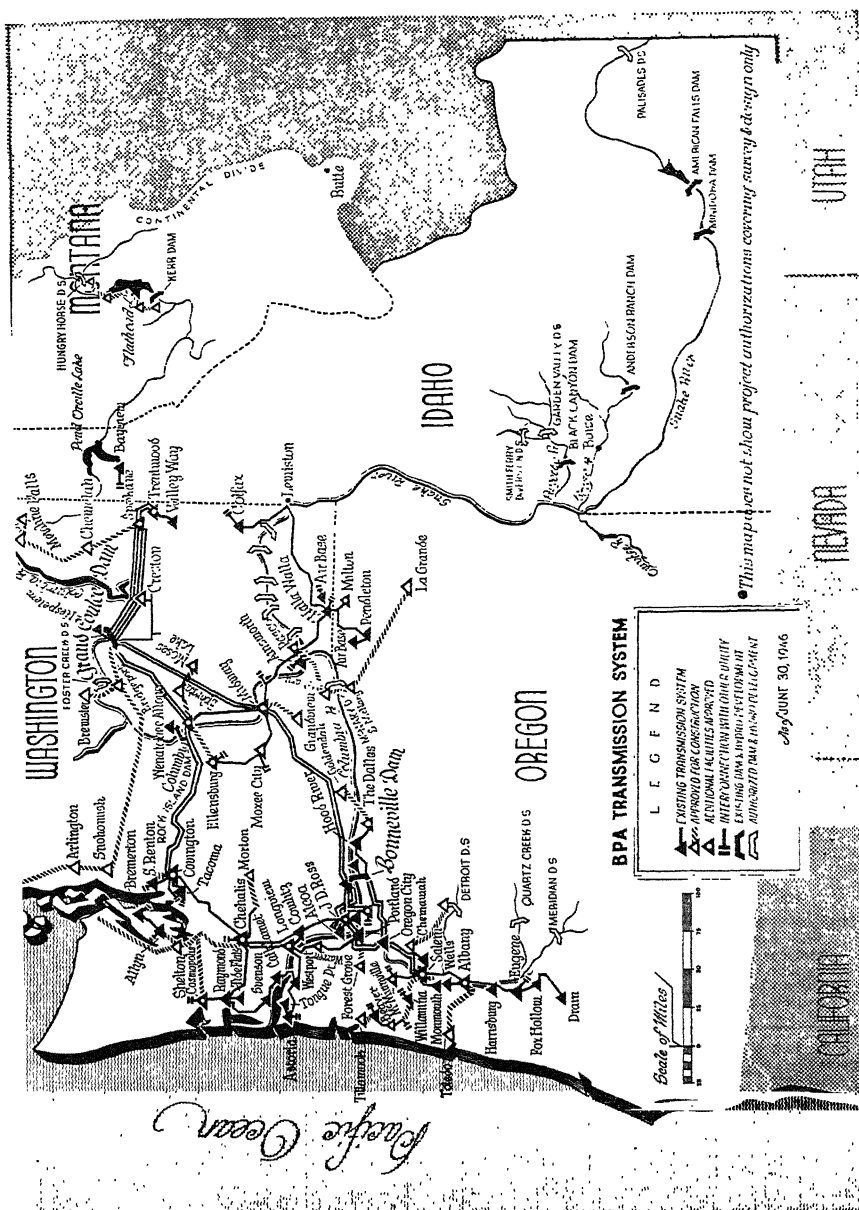
During the fiscal year the Administration served 84 wholesale customers, of which 48 are publicly owned utilities, 6 are privately owned utilities, 11 are military establishments, and 19 are industries. Eight new customers were added during the year with a total maximum demand in June 1946 of 19,857 kilowatts. Four establishments closely allied to the war effort discontinued their demand. Eleven additional delivery points for existing customers were established with a total maximum demand in June 1946 of 9,872 kilowatts.

Transmission System

At the end of fiscal year 1946 Bonneville Power Administration had in operation 2,850 circuit miles of transmission lines and 62 substations. The transmission system consisted of 1,287 miles of 230-kilovolt line; 1,142 miles of 115 kilovolts and 410 miles of lower voltages.

A total of 115.6 circuit miles of transmission lines of all types was placed in service during the fiscal year. This included 50.9 miles of 230-kilovolt line, 6.2 miles of 115-kilovolt line and 57.4 miles of lower voltage line.

The most important construction job of the year was the completion of the 51-mile 230,000-volt Midway-Columbia line and the placing in service of the Columbia substation. The effectiveness of these facilities in strengthening the system was demonstrated during an unscheduled complete shut-down of the Grand Coulee powerhouse on March 11, 1946. The Administration's main 230-kilovolt loop was broken at Grand Coulee, but the new Columbia-Midway line bridged the gap.



Another important project was the 44-mile 33-kilovolt line from Eugene to Drain, Oreg. This line, with the accompanying transformation and substation facilities, which were also built, serves the public agencies in the area, as well as an agency supplying power for the construction of Dorena Dam.

The total in substation transformer capacities on June 30, 1946, was 2,331,000 kilovolt-amperes, a net increase of 65,500 kilovolt-amperes over the preceding year. Actual new installations total 139,500 kilovolt-amperes. However, 74,000 kilovolt-amperes capacity was removed, a large amount compared to the capacity installed and indicating the unusually large number of transformer shifts required to cope with the postwar up-surge of customer loads. In addition to other installations, 49,500 kilovolt-amperes of transformer capacity was placed in service at the Salem Alumina plant, and a second 35,000 kilovolt-amperes synchronous condenser at Covington substation to provide improved voltage regulation and to increase transmission capability into the Seattle-Tacoma area. Table 7 summarizes the Bonneville Power Administration system additions for the fiscal year.

TABLE 7.—*Bonneville Power Administration system additions*

	Circuit miles			
	230 kilovolts	115 kilovolts	Under 115 kilovolts	Total
Transmission lines:				
Placed in operation 1946 fiscal year.....	50.9	6.3	57.4	114.6
Removed from operation 1946 fiscal year.....	-1.7			-1.7
In operation June 30, 1945.....	1,238.0	1,136.0	352.5	2,726.5
Total operated June 30, 1946.....	1,287.2	1,142.3	409.9	2,839.4
Leased to others.....			10.3	10.3
Grand total June 30, 1946.....	1,287.2	1,142.3	420.2	2,849.7
	Installed at end of 1945 fiscal year	Fiscal year 1946		Installed at end of 1946 fiscal year
		Added	Removed	
Substation facilities operated:				
Transformation.....kilovolt-amperes..	¹ 2,265,133	139,500	74,000	² 2,330,633
Static condensers.....do.....	59,110			59,110
Synchronous condensers.....do.....	252,500	35,000		287,500
Substations.....number.....	43	8	1	³ 50
Switching stations.....do.....	11	1		12

¹ Revised to include only facilities in operation. Temporary capacity of 35,334 kilovolt-amperes with portable fans has been deducted.

² All transformers in service. No allowance for temporary added capacity with portable fans. Includes 600 kilovolt-amperes owned, but operated by others.

³ Includes one 600 kilovolt-amperes substation owned, but operated by others.

Despite the end of the war early in the fiscal year, shortages of materials, uncertainty of material deliveries, and the subsequent necessity for changing plans and designs continued to hamper construction progress. Although personnel strength grew during the year, a critical shortage in survey personnel early in the year added to construction problems. Nevertheless

construction kept pace with requirements of customers, and in practically all cases service was provided before the customer's facilities were ready.

The year presented no new operating problems. The cut-back in war loads permitted maintenance forces to inspect and repair equipment and lines that were not before this accessible without curtailing essential service. However, by the end of the fiscal year the load was again increasing.

Bonneville Power Administration's 230-kilovolt-amperes system continued to serve as the backbone for the integrated Pacific Northwest electric utility systems generally known as the Pacific Northwest power pool. There was great variability in the energy deliveries by Bonneville Power Administration to the pool utilities, as compared to the steadiness of deliveries to industrial and military customers. In the peak month of August 1945, for example, combined firm and dump power demand of the seven members of the pool which have interconnections with Bonneville Power Administration was 46.4 percent at the system peak hour, as compared to the average 30 percent of energy deliveries made to these utilities during the whole month and during the fiscal year.

The accompanying chart shows graphically the flow of energy during the week of peak power deliveries (ending August 30, 1945) between interconnected systems of the public and private power agencies of the Northwest.

Power and Regional Development

The outstanding industrial development by the end of fiscal year 1946 was the definite assurance of the reopening within a few months by private enterprise of nearly all the war-built aluminum capacity in the Pacific Northwest. These plants will presently absorb nearly all the surplus power that became available late in 1945 upon the curtailment of war production. In addition to this development the demand of the private utilities rose substantially after the close of the war because of an unexpected increase in other industries and in domestic consumption.

The peak wartime demand of the aluminum industry upon the Bonneville Power Administration power system had been about 660,000 kilowatts. Of this approximately 425,000 kilowatts was dropped at the close of the war. Now, through the leasing of Government-owned plants, in accordance with a disposal program in whose formulation the Administration participated, 400,000 kilowatts is again committed to the aluminum industry.

Under authority of the Bonneville Act, which instructs the Administrator to prevent the monopolization of the power supply by limited groups, a policy was established in 1941, to support measures to promote competition in the aluminum industry. The Administration made technical studies of the problems of disposing of the Government aluminum plants to private industry. These studies were used by the Department of Justice in prepar-

GENERATION BY THE ELECTRIC UTILITY SYSTEMS OF THE PACIFIC NORTHWEST

FISCAL YEAR 1946

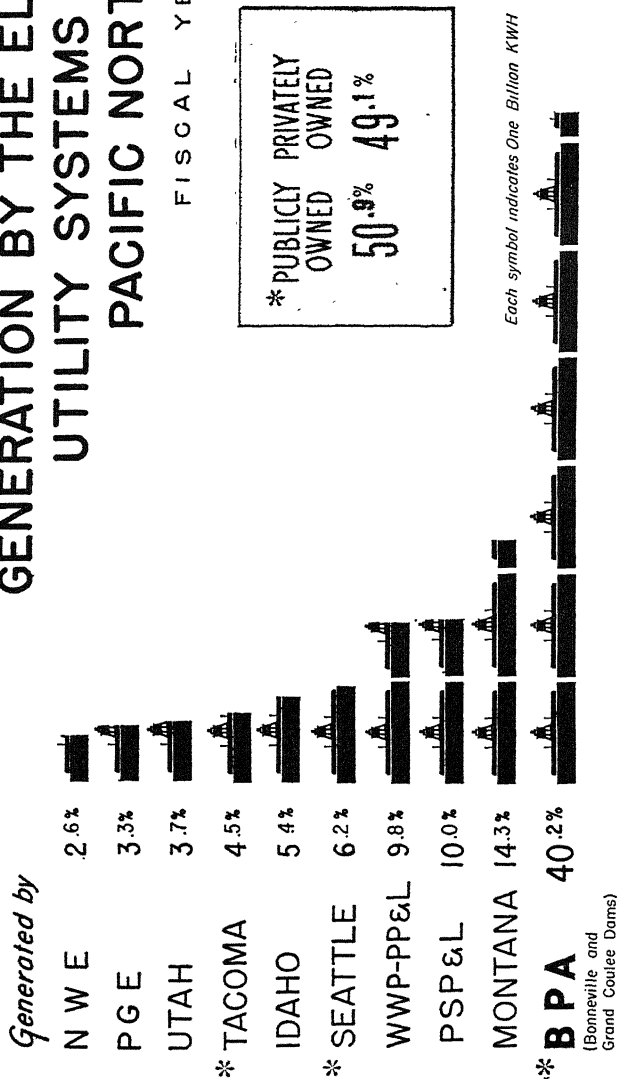


FIGURE 3.

ing its report to Congress recommending that the aluminum plants be so disposed of as to foster competition; they were used by the Reconstruction Finance Corporation in the initial stages of its aluminum plant disposal program; they were also used by the Senate Small Business Committee in preparing its report to Congress on the disposal of aluminum and magnesium plants. The studies also led to a request from the Surplus Property Board that the Administration help formulate the aluminum plant disposal program which was later adopted by Congress.

Other developments in the industrial field, while not comparable to those in the aluminum field as far as their contributions to the Administration's revenues are concerned, have created a healthy diversification in the region's economic activity and are helping to establish a desirable pattern of integrated industrial development.

A large-scale electrolytic iron power plant is to be constructed in the Puget Sound area. One of the war-born carbide plants is to continue operations in the region. Expansion is taking place in regional plants producing chlorine and chlorates, chemical bases for insecticides and weedicides. On these and many other potential industrial developments the staff of the Administration has been in consultation with industry.

In the field of transportation efforts toward the electrification of western railroads resulted in the preparation of a power rate particularly designed to make such electrification feasible. This rate has been submitted to the Federal Power Commission for approval.

To plan for peacetime developments and the extension of residential, rural, and commercial markets for power that would help to take up the cancelled war load, the Administration reactivated its customer utilization section in November 1945. An educational and sales promotion program was designed to widen these markets and to increase utilization by present customers.

The war accelerated a substantial number of new uses for electric power and it is believed that these will continue. The unexpected rise in domestic load, following the end of the war, substantiates this belief. Contacts with the distributors of power and of electrical equipment have been maintained, and activities such as cooking schools, group demonstrations, appliance exhibits, and dealer meetings have been carried on to lay a basis of friendly and remunerative working relations.

Close relations with the Rural Electrification Administration have been maintained so that Bonneville's Power Administration's program of utilization will be closely coordinated with Rural Electrification Administration's plans. Similar relations have been maintained with other organizations involved in the development of rural electrical usage.

Irrigation and the latest developments in this field have revealed extensive opportunities for power-load development. During the year over

24,000 kilowatts in small sprinkler units (the more recent development in irrigation methods) have been installed to irrigate 16,000 acres of land. The Administration has prepared engineering studies for a number of irrigation districts.

Electric space heating (house heating) as an outlet for power has been another field of intensive inquiry. The public acceptance and demand for this type of heating is much in advance of industry's ability to supply equipment or the power distributors' ability to supply service. Bonneville Power Administration has worked with distributors and manufacturers of heating equipment with a view to meeting the public demand on a basis satisfactory to all.

Pursuing the plan of making accurate and detailed data available to potential industrial customers, the Administration has continued the preparation of its County Surveys—"The Economic Base for Power Markets." Seven new ones have appeared this year, and more are in preparation. Reports on mineral resources and on Pacific Northwest limestone were also completed. Early in 1945 a set of reports on industrial power prospects in the Pacific Northwest was begun for the War Department. These are to be used in a comprehensive report on the Columbia River basin to be submitted to Congress. A number of industrial research projects were conducted in collaboration with the colleges of the region in accordance with the special agreements set up by the Administration with a number of institutions of higher learning in the Pacific Northwest.

Local Distribution

The Administration has established three schedules of resale rates which are set up as standards for the retail distributors who purchase Bonneville-Grand Coulee power at the very favorable Federal wholesale rate. In accordance with the mandate of the Bonneville Act the Administration has cooperated with its customers to have the benefits of the low rates passed on to the citizen-consumers of the region. All contracts with publicly owned utilities bear some agreement toward this end, with the Bonneville standard resale rates generally accepted as an objective toward which the distributor should aim. In the case of the privately owned utilities this problem has still to be solved.

The schedules of resale rates set up by the Administration apply to residential, commercial, and street-lighting customers and set forth in detail the rates, minimum charges, methods of payment, delivery points, metering, and other pertinent matters.

For residential customers the recommended rates are as follows:

- First 50 kilowatt-hours per month at 3 cents per kilowatt-hour.
- Next 50 kilowatt-hours per month at 2 cents per kilowatt-hour.
- Next 200 kilowatt-hours per month at 1 cent per kilowatt-hour.
- Next 900 kilowatt-hours per month at $\frac{1}{2}$ cent per kilowatt-hour.
- Over 1,200 kilowatt-hours per month at $\frac{3}{4}$ cent per kilowatt-hour.

For commercial users the rates are as follows:

Energy charge:

- First 150 kilowatt-hours per month at 3 cents per kilowatt-hour.
- Next 350 kilowatt-hours per month at 2 cents per kilowatt-hour.
- Next 1,000 kilowatt-hours per month at 1 cent per kilowatt-hour.
- Next 13,500 kilowatt-hours per month at 0.8 cent per kilowatt-hour.
- Next 50,000 kilowatt-hours per month at 0.5 cent per kilowatt-hour.
- Excess above 65,000 kilowatt-hours per month at 0.3 cent per kilowatt-hour.

Demand charge:

- First 10 kilowatts demand per month, no charge.
- Excess above 10 kilowatts demand per month at 95 cents per kilowatt.

The standard street lighting rate consists of two parts, an energy charge and an investment charge, and applies for a term of not less than 1 year.

Table 8 indicates the energy deliveries to all types of customers by Bonneville Power Administration during fiscal year 1946. Table 9 lists all types of new customers provided with service during 1946.

TABLE 8.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1946

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS		
Public owned utilities:		
Municipalities:		
	<i>Kilowatt-hours</i>	
Canby, Oreg.	2, 227, 200.	February 1940.
Cascade Locks, Oreg.	1, 890, 600	March 1939.
Centralia, Wash.	176, 000	January 1941.
Drain, Oreg.	1, 036, 040	April 1941.
Ellensburg, Wash.	5, 943, 600	May 1941.
Forest Grove, Oreg.	7, 414, 400	December 1939.
Grand Coulee, Wash.	4, 454, 400	January 1942.
McMinnville, Oreg.	21, 135, 000	October 1940.
Milton, Oreg.	302, 400	June 1946.
Monmouth, Oreg.	2, 340, 800	December 1940.
Total municipalities.	46, 920, 440	
Public utility districts:		
Clark County Public Utility District No. 1. .		
Air Reduction.	3, 002, 000	August 1942.
City Limits.	1, 540, 129	May 1946.
Dormitory.	4, 877, 875	September 1942.
Harney.	7, 928, 376	January 1946.
Mill Plain.	54, 230, 400	September 1942.
Vancouver Shipyard.	1, 162, 125	May 1946.
Clatskanie Public Utility District.	1, 611, 724	March 1943.
Cowlitz County Public Utility District No. 1.	111, 397, 447	August 1941.
Grant County Public Utility District No. 2		
Soap Lake.	1, 573, 600	August 1942.
Coulee City.	657, 700	August 1942.
Grays Harbor County Public Utility District No. 1.	70, 853, 000	November 1940.
Kittitas County Public Utility District No. 1.	1, 272, 300	June 1941.
Klickitat County Public Utility District No. 1.	807, 540	November 1940.

TABLE 8.—Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1946—Continued

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS—continued		
Public owned utilities—Continued		
Public utility districts:	<i>Kilowatt-hours</i>	
Lewis County Public Utility District No. 1:		
Mossyrock.....	3, 268, 800	May 1941.
Elbe.....	2, 489, 752	October 1945.
Pacific County Public Utility District No. 2:		
Raymond.....	12, 048, 347	October 1940.
Naselle.....	7, 241, 400	November 1940.
Dredge.....	699, 720	April 1946.
Skamania County Public Utility District No. 1:		
Stevenson.....	3, 285, 600	January 1940.
White Salmon.....	916, 200	April 1942.
Bonneville Dam.....	12, 000	January 1943.
Wahkiakum County Public Utility District No. 1:		
Cathlamet.....	3, 280, 800	November 1940.
Svenson.....	804, 720	Do.
Total public utility districts.....	294, 961, 555	
Cooperatives:		
Benton-Lincoln Electric Cooperative:		
Albany.....	4, 009, 680	October 1940.
Harrisburg.....	84, 700	May 1946.
Benton Rural Electric Association:		
Prosser.....	2, 176, 200	July 1942.
Grandview.....	2, 319, 000	Do.
Big Bend Electric Cooperative:		
Ritzville.....	1, 650, 400	August 1942.
Delight.....	351, 104	August 1945.
Blachly-Lane Electric Cooperative.....	364, 200	September 1945.
Clearwater Valley Light & Power.....	4, 732, 000	August 1942.
Columbia County Rural Electric Association.	2, 825, 520	July 1941.
Douglas Electric Cooperative:		
Oakland.....	2, 573, 315	Do.
Brockway Junction.....	763, 800	September 1941.
Hood River Electric Cooperative.....	11, 200	May 1946.
Idaho County Light and Power Cooperative.	878, 500	August 1942.
Inland Empire Rural Electric Association:		
Colfax.....	7, 154, 800	Do.
Geiger.....	68, 950	June 1946.
Opportunity.....	5, 528, 900	August 1942.
Spring Valley.....	44, 700	June 1946.
St. Johns.....	59, 400	Do.
Valley Way.....	74, 200	Do.
Kootenai County Rural Electric Association:		
Coeur d'Alene.....	2, 253, 400	August 1942.
Harrison Flats.....	135, 450	Do.
Lane County Electric Cooperative.....	180, 420	March 1946.
Lincoln Electric Cooperative		
Davenport.....	1, 530, 918	April 1942.
Almira.....	1, 941, 876	Do.
Nehalem Valley Electric Cooperative.....	417, 360	February 1941.
Nespelem Valley Electric Cooperative.....	1, 197, 980	September 1941.
Northern Idaho Rural Electric Association..	1, 501, 500	May 1943.

TABLE 8.—*Energy deliveries to customers of the Bonneville Power Administration, fiscal year ending June 30, 1946—Continued*

	Energy deliveries for year	Date of initial service
DELIVERIES UNDER POWER CONTRACTS—continued		
Public owned utilities—Continued		
Cooperatives—Continued	<i>Kilowatt-hours</i>	
Okanogan County Rural Electric Association.	678, 480	August 1942.
Pend Oreille Electric Cooperative.....	789, 480	May 1943.
Salem Electric Cooperative		
West.....	4, 714, 080	March 1941.
North.....	1, 078, 800	October 1945.
Stevens County Electric Cooperative		
Addy.....	1, 129, 860	August 1942.
Evans.....	2, 613, 900	Do.
Umatilla Electric Cooperative		
Substation.....	2, 169, 798	July 1942.
Depot.....	3, 246, 354	February 1943.
Wasco Electric Cooperative.....	1, 233, 300	May 1941.
West Oregon Electric Cooperative.....	212, 400	December 1945.
Total Cooperatives.....	62, 695, 925	
Irrigation district:		
Vera irrigation district No. 15.....	1, 920, 804	Do.
Total publicly-owned utilities.....	406, 498, 724	
Privately owned utilities:		
Mountain States Power Co.....	4, 341, 000	August 1943.
Pacific Power & Light Co.....	32, 331, 515	June 1941.
Portland General Electric Co.....	883, 222, 000	December 1939.
Puget Sound Power & Light Co.....	730, 654, 000	October 1943.
WWP-PP&L-NE Companies.....	90, 935, 000	
Total privately owned utilities.....	1, 741, 483, 515	
Military establishments (13).....	59, 969, 776	
Industries (21).....	3, 232, 384, 635	
Total under power contracts.....	5, 440, 336, 650	
DELIVERIES UNDER EXCHANGE AGREEMENTS		
Publicly owned utilities:		
Eugene, Oreg.....	13, 344, 000	
Seattle, Wash.....	97, 295, 000	
Tacoma, Wash.....	118, 146, 000	
Total publicly owned utilities.....	228, 785, 000	
Privately owned utilities:		
California-Oregon Power Co.....	17, 615, 000	
Mountain States Power Co.....	2, 000	
Pacific Power & Light Co.....	19, 623, 485	
Portland General Electric Co.....	18, 000	
WWP-PP&L Companies.....	124, 766, 374	
Total privately owned utilities.....	162, 024, 859	
Total exchange.....	390, 809, 859	
Total of energy sales under power contracts and exchange.....	5, 831, 146, 509	

TABLE 9.—*List of customers provided new services by Bonneville Power Administration during the fiscal year ending June 30, 1946*

Customer	New customer contract demand	Additional point of delivery	From transfer to direct service	Additional capacity
Public or peoples' utility districts:	<i>Kilowatts</i>			<i>Kilowatts</i>
Clark County, Wash., Public Utility District No. 1.	-----	Harney-----	Harney to city limits.	3,000
Clark County, Wash., Public Utility District No. 1.	-----	Vancouver Shipyards-----	-----	2,000
Grays Harbor County, Wash., Public Utility District No. 1.	-----	-----	-----	500
Lewis County, Wash., Public Utility District No. 1.	-----	Elbe-----	-----	500
Pacific County, Wash., Public Utility District No. 2.	-----	Tide Flats-----	-----	1,000
Cooperatives:				
Benton-Lincoln Electric Cooperative, Inc.	-----	Harrisburg-----	-----	200
Big Bend Electric Cooperative, Inc.	-----	Delight-----	-----	100
Blachly-Lane County Cooperative Electric Association.	40	-----	-----	-----
Douglas Electric Cooperative, Inc.	-----	-----	Oakland to Drain-----	-----
Hood River Electric Cooperative.	200	-----	-----	-----
Inland Empire Rural Electric, Inc.	-----	{ Geiger ¹ Spring Valley ¹ St. John ¹	} Valley Way ¹ -----	-----
Lane County Electric Cooperative, Inc.	100	-----	-----	-----
Salem Electric.	-----	North Salem-----	-----	100
West Oregon Electric Cooperative, Inc.	100	-----	-----	-----
Municipalities:				
City of Drain, Oreg.	-----	-----	Douglas Electric Cooperative to Drain.	-----
Milton City, Oreg.	500	-----	-----	-----
Irrigation districts: Vera Irrigation district No. 15.	500	-----	-----	-----
Industries:				
General Construction Co.	1,500	-----	-----	-----
Salem Alumina plant.	² 55,000	-----	-----	-----

¹ Load at opportunity transferred to these 4 points.² Capacity to be made available by Bonneville Power Administration upon demand.

Bonneville Power Administration Advance Program

The advance program planned by the Administration for the six fiscal years 1947 to 1953 reflects the planning and construction of the transmission system which was deferred because of wartime restrictions, deficiencies in manpower, and shortages of critical material. It also reflects the findings of several comprehensive regional studies being jointly made by the Administration, the Bureau of Reclamation, and the United States Corps of Engineers.

The program is based on an estimated load growth of approximately 285,000 kilowatts per year for the entire service area. Although by December 1945 the firm power peak load of Bonneville Power Administration had dropped to 720,000 kilowatts (approximately 50 percent below the wartime peak) because of the closing of war plants, it was anticipated that the peak load for December 1946 would exceed 1,200,000 kilowatts. The expected peak load forecast for December 1947 exceeds the previous all time peak of January 1945, which was 1,427,000 kilowatts.

The demands of the light metals industry and the demands of other industries, which are expected to equal each other by 1952, account for a large portion of the future loads of the Administration. In addition, very significant increases in loads are expected for the wholesale customers who resell Bonneville power to ultimate consumers. These include the privately owned utilities of the region as well as a large number of publicly owned distributors. Contrary to expectations, the loads of the large privately owned utilities continued to increase following the war. These loads will undoubtedly continue to grow, and most of the increased demands of their systems will need to be met by purchases from the Administration since the large utilities are not, on the whole, planning any significant increases in generating facilities. Even greater increase is expected on the systems of the smaller publicly owned distributors, most of which depend on Bonneville Power Administration for power.

Considering the growth in the demands of industrial and utility customers it is forecast that the peak load of the Administration will double between 1947 and 1952, and that it will increase another million kilowatts by 1955.

To meet this demand will require the maximum utilization of the generating facilities of nine additional multipurpose projects scheduled for construction from 1948 to 1953 in Idaho and western Montana, and on the Columbia, Lower Snake and Willamette Rivers. To interconnect the generating plants of these projects with present and developing load centers will require the construction of about 1,500 miles of 230-kilovolt main line transmission grid, and 1,200 miles of 115-kilovolt and lower voltage lines, with the necessary substation capacity. This construction, during the 6-year period, will cost approximately \$40 million per year.

The resulting transmission grid will make possible an integrated operation of all electric power facilities in the Northwest. The economies resulting from such integrated operation will, to some extent, offset the rapidly increasing price levels of material and labor and should help maintain the low level of electric power costs upon which the development of the region is dependent.

The advance program also reflects the expressed postwar demand for public ownership of electric distribution facilities throughout the service area. Increased distribution of electricity on a nonprofit basis by public utility districts, municipalities, and cooperatives will mean greater use of power at the lower retail rates. There will thus be greater loads on the Bonneville system. Since public agencies are preferred customers, under the Bonneville Act, their increased demand may, during critical periods, affect the actual dispatching of power according to priority.

Wholesale Power Rates

The basic rate structure for Bonneville-Grand Coulee power is officially designated the C-rate and establishes \$17.50 per kilowatt-year as the price of power anywhere on the transmission system beyond 15 miles from

the dam. (At the dam, and within 15 miles of it, the rate falls to \$14.50 per kilowatt-year.) Several optional rates are available to customers, but all are consistent with the \$17.50 rate level.

A revised set of wholesale rates, including A-4, C-4, E-3, F-3, and H-3 schedules, and General Rate Schedule Provisions, was made effective March 1, 1946. Major changes were made in the E-3 and F-3 schedules in the provisions for irrigation and drainage pumping service, and in the 2.5 mill dump energy H-3 schedule by which the rate is extended to apply to energy delivered for experimental purposes, and the adjustment for power factor is omitted.

The basic kilowatt-year rate has been particularly effective in encouraging growth of industries using electricity at a high load factor and in such quantities as to make power an important item in their costs of manufacture. The postwar industrial development made it advisable to devise several new wholesale power rates which have been filed with the Federal Power Commission for approval.

A new wholesale power rate, schedule R-1, applies primarily to railroad electrification, although it is made available to any type of industry having the load characteristics specified under the rate. Service is supplied at 4 mills per kilowatt-hour and is restricted to loads that coincide favorably both with the availability of power on the Bonneville system and with the system load curve.

Another proposed rate, schedule S-1, covers the sale of secondary energy at the low rate of 1 mill per kilowatt-hour. This rate has been designed to market a limited quantity of byproduct power, to make such power available in the most advantageous manner in the development of the region, and yet to provide a maximum of revenue. It covers energy to be used in industrial processes which can shut down operations for limited periods without serious effect on employment or on the economy of the community, and is restricted to purchasers of firm power or to purchasers who maintain standby facilities which can be used when secondary energy is not available.

A new wholesale power rate provision for irrigation pumping service is to be incorporated in schedule E-3. This establishes a yearly maximum charge of \$6 per kilowatt, which includes all charges for service except energy charges for usage prior to May 1 and after September 30. The rate has been fixed as low as possible, recognizing the character of the power to be supplied and all favorable factors, but avoiding subsidy for irrigation. The other special irrigation pumping provisions of existing wholesale rates will remain in effect. The sale of irrigation pumping power is correlated with the sale of space heating power so that the two loads together make use of a block of firm power, the irrigation pumping using it in the summer and the space heating in the winter.

Further studies are being continued on necessary revisions or adaptations of the existing schedules to meet the requirements of industries and

various types of loads. Particularly in the forefront are studies of appropriate rate schedule provisions for space heating service.

Important Special Studies

During the past fiscal year the Bonneville Power Administration's Payout Report was completed and presented to Congress. This study showed that the present wholesale rates will fully cover the operation and maintenance expenses of the Administration and those of the Bonneville and Columbia Basin (Grand Coulee) projects allocated to power and that reimbursable construction costs, including replacements, allocated to power will be returned to the Treasury with interest within 50 years from the date such construction costs are incurred.

This was the first time since the inception of the Administration that such a report could be made, for it had to wait on the completion of the study of the allocation of the construction costs of Bonneville and Grand Coulee Dams, and on the first independent commercial-type audit of the accounts of the Administration, both of which were concluded last year. A new independent audit is now being made for fiscal year 1946 and a revision of the payout schedules will follow its completion. Because the audit is still in progress no formal balance sheet for the fiscal year appears with this annual report. Until it is completed a statement will not be available, but as soon as it is possible the Administration will make a separate financial report.

The significance of the payout report has been recognized by the Bonneville Advisory Board which has appointed a special committee to prepare a payout analysis that will include additional Columbia River drainage basin projects in the total picture. Further, the Columbia Basin Inter-Agency Committee has appointed a special committee to analyze the problems involved in the payout analysis and related financial operations and to make recommendations for their solution.

Another important study was the report on the Upper Snake Basin in Idaho, with special reference to the power needs and potentialities, conducted jointly by the Administration and the Bureau of Reclamation. This report, made at the request of the Secretary of the Interior, is just being completed.

Personnel

The personnel of the Administration, including those on leave without pay, on June 30, 1946, totaled 2,173. The Personnel Division was thoroughly reorganized to meet peacetime conversion demands. Training and employment functions were materially strengthened and miscellaneous services involving employee-supervisor relations were consolidated.

Three-fourths of the military furlough employees returned to the Administration and were successfully placed. This is noteworthy since there were at one time over 1,200 employees on military furlough, with an active Ad-

ministration pay roll of only 1,800. Definite action was begun on the problem of placing disabled veterans.

The labor relations program of the Administration, formally expressed in the Collective Bargaining Agreement signed May 2, 1945, was strengthened and implemented by the passage of House bill 2690 on October 23, 1945. Under amendments to the Bonneville Act contained in this act, wage board procedures were eliminated; and the Administration became the first regular Federal agency to extend the retirement protection of the Social Security Act to all laborers, mechanics and workmen not subject to the Civil Service Retirement Act, and to provide unemployment compensation for all hourly paid employees.

To assure the Administration a permanent nucleus of competent trained workmen skilled in the techniques and procedures required in the operation of the Bonneville-Grand Coulee transmission system, provision was made for a utility crew of permanent hourly employees, kept to a minimum in size and enjoying full civil service, unemployment compensation, and travel expense rights; fluctuations in construction operation are met by hiring temporary construction employees without civil service and travel expense rights. To provide effective utilization of existing skilled personnel, equipment operations of various organizational units were combined in a central equipment pool, the operators being assigned with the machines to field work as required.

Relations with universities and colleges in the Pacific Northwest were reopened, by providing summer employment at the Administration for college juniors and seniors who would become acquainted with the procedures and techniques of the Administration.

Intensified work on employee-supervisor relations was reflected in the complete overhauling of the efficiency-rating program and the revitalizing of programs for employee suggestions and awards for superior accomplishments. Closer tie-in between the day-to-day administrative problems and management needs of the organization was secured through the formation of a management council for top administrative officials.

Employee interest in the work of the Administration was furthered by intensive orientation work and by the appearance of an official informational weekly, "BPA Currents." The Bonneville Associates, an employee welfare organization, won first prize in the noncommercial division at the Portland Rose Festival parade with their float, "Power for Peace."

Although limited by law in the development of a medical program, the Administration secured the cooperation of the Multnomah County Health Department in making official physical examinations of hourly employees, for which the Administrator was permitted, by law, to hire medical services.

Nearly 400 safety meetings were held during the year, and the Administration won the first award of the Portland Safety Traffic Commission in the Government division.

Highlights of Fiscal Year 1946

Return of the war load as a peace load.—Quick return of the war load on a peacetime production basis changed the emphasis from selling a power surplus to finding an adequate power supply for the immediate future and for the next 6 years, and stood out as the Administration's preeminent highlight of fiscal year 1946. The restoration of this load has many immediately favorable implications for the region's reconversion and reemployment situation as well as for progress in its industrial development and diversification.

However, the power supply problem is very pressing, if it is not to hamper continuing development and well-being in the Pacific Northwest. The general regional power shortage can be met in time only by construction of more dams in the multiple-purpose river development program, and of additional transmission lines. Accelerated installation of additional generators at Grand Coulee and wherever else feasible, can help meet the immediate needs. The power shortage can certainly not properly be met by curtailing power use if development is to proceed and valuable industrial prospects not be lost. The power-supply program and the power-use program, both of which require action some years in advance of actual results, if developed on a parallel basis, will insure no delay or curtailment in the basic development of the region.

Staff-development program.—With the end of the war and of the problems of dislocation in staff personnel the war had inevitably caused, and with the return of employees from war furlough, a thorough staff-development plan has been formulated. This is composed of several programs involving various sections of the staff. It includes 20 sessions of conferences, lectures, and studies for supervisory personnel; an indoctrination course for employees in the field of management and public utility operation; training for student aids, recruited from Pacific Northwest institutions of higher learning for summer apprenticeship at the Administration; enlargement of the training program for apprentices within the agency; tours of familiarization for all employees through all operations of the organization; and systematic dissemination of general information about the Administration and its activities among all employees. Such a coordinated and far-reaching plan will increase the feeling of unity within the organization and heighten the morale, interest, and knowledge of the staff.

Bonneville Regional Advisory Council.—The continued and constructive functioning of the Administration's unique experiment in grass-roots advisory participation is another of the notable high lights of the year. Membership in the council has been somewhat enlarged, and the members, who attend at their own expense, have demonstrated an active and continuing interest in the proceedings. Recommendations of the council have been of invaluable aid to the Administration in carrying out its program.

During the past year the council has particularly considered regional research in relation to the operations of the Bonneville Power Administration and the merits of a broadened and coordinated interagency research program as a medium for aiding the development of the region. The council has placed on record recommendations that (1) an amendment to the Bonneville Act be drafted, for further consideration by the council, which will specifically state the responsibility of the Bonneville Power Administration in the field of research as a power marketing agency; and that (2) a program of coordination of research activities for agencies in the region be developed and presented to the council for consideration.

Bonneville Advisory Board.—During the past 8 years the Administrator has, at intervals, consulted with the Bonneville Advisory Board, established by the Bonneville Act to function in an advisory capacity. As required by the act the Board has been composed of representatives designated by the Secretaries of War, Interior, and Agriculture, and by the Federal Power Commission. Composed largely of busy officials of the national level, the Board has found it difficult, especially during the war, to arrange meetings, which generally had to take place in Washington.

In view of the fact that the Bonneville Power Administration is an exclusively regional agency its Administrator has for some time felt that a Board more intimately concerned with the region could meet more easily and more effectively. Early in 1946 the Secretary of the Interior, therefore, designated a regional official to act for his Department, on the Board, and the other three departments concerned shortly followed suit. The Board is now meeting on a regional quarterly basis.

The most recent meeting of the Bonneville Advisory Board was held at Boise, Idaho, on June 5, 1946. At this meeting a subcommittee was appointed to report on the matter of costs and payout with the object of getting interagency agreement on all financial matters relating to the multiple-purpose projects involving power, in which the various agencies are jointly interested.

Columbia Basin Inter-Agency Committee.—This Committee was formed in the spring of 1946 by the Federal Inter-Agency River Basin Committee for the purpose of coordinating, planning, construction, and administration of the multiple-purpose development programs of the region. Membership coincides with the membership of the Bonneville Advisory Board to facilitate coordination of activities and to avoid duplication of effort, and consists of the following regional officers: War Department—Col. Theron D. Weaver, Division Engineer (Chairman, 1946–47); Interior Department—R. J. Newell, Regional Director, Bureau of Reclamation; Department of Agriculture—George T. Hudson, Office of Secretary; Federal Power Commission—Leshner S. Wing, Regional Engineer; and Bonneville Power Administration—Paul J. Raver, Administrator (who is Chairman of the Bonneville Advisory Board).

The Committee has held monthly meetings and has supplied a much needed vehicle for interagency information and correlation.

Southwestern Power Administration

DOUGLAS G. WRIGHT, *Administrator*



CREATED by order of the Secretary of the Interior on August 31, 1943, the Southwestern Power Administration since has functioned for the purpose of fulfilling the requirements expressed in Executive Orders 9366 and 9373 which provided for unified administrative control during the war of the Grand River Dam project in northeast Oklahoma, and the marketing of power generated by that project, and the additional marketing of power generated by the hydroelectric plants at the Norfork Dam project in north-central Arkansas and the Denison Dam project located on the Texas-Oklahoma border. The Norfork and Denison projects are operated by the United States Army Corps of Engineers, the Administration being concerned solely with marketing the electric energy at wholesale.

During the war approximately 95 percent of the energy produced at the three projects went directly into the war effort. Heavy war loads were sold to the Defense Plant Corporation's aluminum plant at Jones Mills, Ark.; Camp Gruber, near Muskogee, Okla.; the Oklahoma Ordnance Works, near Pryor, Okla.; and the Cardox Corporation at Claremore, Okla.

Revenues derived from the sale of power from the three plants during the fiscal year ended June 30, 1946, totaled \$2,254,918.43 despite the fact that the Norfork and Denison projects do not have the advantages of Government transmission line facilities their production being delivered to private companies at the generating plant sites.

Grand River Dam Project

The Grand River Dam project was constructed by the Grand River Dam Authority, an agency of the State of Oklahoma, under a Public Works Administration loan and grant agreement. Construction was started in 1938 and the plant began commercial operation on May 1, 1941. It was taken over on November 21, 1941, by the United States Government from the State of Oklahoma under section 16 of the Federal Power Act, to be completed and operated by the Government to furnish power for the Nation's defense and for the war and was operated by the FWA from that time

until September 1, 1943, when it was transferred to the Department of the Interior.

During the 1946 fiscal year gross receipts from power sales amounted to \$999,929.53, thus bringing the total revenue for the period since the project has been under Federal control to a grand total of \$6,413,082.41.

A bill was introduced and passed during the second session of the Seventy-ninth Congress to return control of the Grand River Dam project to the State of Oklahoma. This project is scheduled to be turned back to the State Authority during the first quarter of the 1947 fiscal year.

During its final year of operating the Grand River project the Federal Government continued to improve and expand the plant's facilities and transmission system. Installation of a fifth 15,000 kilowatt generating unit, ordered in 1941 but held up until 1944 on account of war needs with higher priorities, was continued and the unit should become an integral part of the hydro plant by November 1946.

Improvements to spillways were completed and several contracts were awarded for construction of transmission lines in the northeast Oklahoma area served by the project. One of the most important transmission-line contracts effected was the 110-kilovolt from Okay, Okla., to the site of the Fort Gibson Dam, now under construction in eastern Oklahoma by the Corps of Engineers. This line will serve all construction activities for the new multiple-purpose project.

The proposed contract, attending the return of the project to the control of the State of Oklahoma, provides that the Authority may assume, at its option, any construction which may be in progress. Present plans indicate that construction which will not be completed by November 1, 1946, will be assumed by the Grand River Dam Authority while all other construction will be assumed by the Southwestern Power Administration.

Norfolk Dam Project

The President, under Executive Order 9366, assigned to the Secretary of the Interior the responsibility of marketing the power generated at the Norfolk Dam project in north-central Arkansas.

The Norfolk project is a combined flood-control and hydroelectric development, located on the North Fork of the White River, and constructed and operated by the United States Army Corps of Engineers. The generation plant was built with an initial installation of one 35,000-kilowatt unit with provision for installation of three additional units. The total estimated cost of the project is \$26,000,000.

Orders have been placed for the second generating unit and installation should begin early next year.

Since the Government has no adequate transmission system leading out of the Norfolk project, energy generated there since the beginning of commercial operation, March 6, 1945, has gone to nearby private utilities.

Revenue from sale of energy under these circumstances amounted to \$496,384.98 during the 1946 fiscal year.

Denison Dam Project

The Denison Dam project, also built and operated by the Corps of Engineers, is located on the main stem of the Red River on the Texas-Oklahoma border near Denison, Tex.

Like the Norfolk project, the Denison project is a combined hydroelectric and flood-control development with an over-all estimated cost of \$54,000,000. The initial installation consists of one 35,000 kilowatt generating unit. A second identical unit is on order and will be installed probably during the 1948 fiscal year. When completed the plant will have five 35,000-kilowatt units.

The Denison plant did not go into commercial operation until March 9, 1945, and, like the Arkansas project, delivered its produced energy to private companies at the plant site due to lack of transmission facilities. Gross receipts from power sales during the 1946 fiscal year amounted to \$758,-603.92.

Postwar Potentialities

The war had moved into its final phases when the Flood Control Act of 1944 assigned to the Secretary of the Interior the duties of marketing the power generated at all multiple purpose dams already built and scheduled for future construction by the War Department. Under the Flood Control Act, Federal agencies, public bodies and cooperatives, and private companies, in that order of preference, were to be served by the Department, and authorization was given for the construction or acquisition of necessary transmission lines and related facilities to accomplish the assignment.

Taking cognizance of the fact that the war years had brought about a strong tendency toward the decentralization of industry and sensing the eventual loss of heavy war-time energy sales, the Administrator of the Southwestern Power Administration made a thorough study, even before the war's close, covering all of the constructed, authorized and proposed War Department projects on the Arkansas, White, Ouachita, Red, Brazos, Neches, and Guadalupe Rivers. This study stemmed from a desire to learn the postwar potentialities of the affected area and determine what benefits might be derived from low cost electric power.

It was evident that the area served by the Administration had prodigious natural resources from which great mineral, industrial and agricultural wealth could be developed rapidly and the detailed study and survey gave graphic evidence that the ultimate goal could be attained more rapidly with the improvement of power distribution.

To fulfill this urgent need for hydroelectric energy, the Administration decided, after further study, that the most efficient method of accomplish-

ing the task at hand was through coordination of the various hydroelectric generating plants already in operation with an over-all plan for adding future plants to the grid upon completion of their construction. The conclusions and recommendations which grew out of these studies were included in a report to the Secretary entitled, "Report of Comprehensive Plan for Power Distribution and Sales from Hydroelectric Projects Authorized by the Flood Control Act, December 1944 (H. R. 4485) in the Southwestern Region—Arkansas, Oklahoma, Texas, Louisiana, southeastern Kansas, southern Missouri."

This report was placed before the Seventy-ninth Congress along with a request for appropriation of funds necessary to carry out the proposed program.

With the two sources from which the Administration was to market electric energy—Norfolk and Denison—separated by hundreds of miles, and since it was deemed necessary to coordinate their produced energy, it was proposed that these two projects be brought together electrically through the medium of heavy transmission lines.

To accomplish this end, it was proposed that a heavy 154-kilovolt transmission line be built from the Norfolk project to a point near Ola, Ark., where it could be joined with the 154-kilovolt line built during the war by the Ark-La Electric Cooperative for the transmission of electric power from the Grand River Dam project to the Defense Plant Corporation's aluminum plant at Jones Mill, Ark. It was further proposed that the Administration purchase that portion of the Ark-La line which extends from the proposed Ola tie-in to the western terminus of the line at Markham Ferry in northeastern Oklahoma.

From Markham Ferry the proposal requesting construction of a 154-kilovolt line to Tulsa, Okla., and a 132-kilovolt line from the Oklahoma City to the Denison hydroelectric plant.

Marketing Policies

Studies of both available and potential markets for disposition of the electric power have been made and a program of encouraging peacetime industries to locate in the areas which could be served by an efficient and practical power grid has been progressing for 2 years.

The area studied by the Administration was slightly different from that studied by the Federal Power Commission in its survey because of the assignment of particular watersheds to this agency but the results of the Administration's studies checked very closely with the conclusions of the power market survey of the Federal Power Commission.

In the development of the market studies, certain factors that would govern operating policy and consideration of the best use of the projects in question had to be taken into account. They were based on the theory

that the best possible use that could be made of the power generated at the hydroelectric developments was to encourage and foster complete rural electrification; to furnish power to public bodies owning their own power facilities wherever such action would be of benefit to them; to encourage new industries and stabilize existing industries; to effect power interchange arrangements; and to furnish peak capacity to existing utility systems and utilize the unused off-peak generating capacity available in their systems to firm up the hydro developments.

Marketing policies to be employed by the Administration will be in strict accordance with the public power policy as set forth by the Congress. However, adequate transmission and distribution facilities must be made available either by utilizing existing facilities or the construction of new facilities to transmit the power from the interconnected hydroelectric developments to the load centers of the area, and to prospective users of the electric service if the most widespread use of the electric power and energy at the lowest possible rate to the consumer is to be secured.

Bureau of Mines

R. R. SAYERS, *Director*



Foreword

THE accelerated depletion of much of this Nation's irreplaceable mineral wealth during the war years and a virtual moratorium on new discoveries impelled the Bureau of Mines to readjust its activities in the fiscal year 1946 to meet another challenge—the development of a peacetime mineral economy effectively integrating technologic advancements made in the war.

Under the stress of wartime necessity, the Bureau had developed certain high-cost processes and techniques for beneficiating low-grade domestic ore reserves. Some of these methods are not adaptable to a peacetime economy, and they are being carefully examined and redesigned to fit in with the increased production of civilian commodities. The Bureau's program of mining research and investigations of domestic mineral deposits has been designed so that it may be expanded rapidly and effectively if necessary to assist in the administration of stock-piling legislation approved by the Congress.

Curtailling somewhat its far-flung search for unexploited mineral deposits in the United States and Alaska, the Bureau last year concentrated upon metals or minerals in which this Nation no longer is self-sufficient or upon those sorely depleted by the demands of war. At Bureau metallurgical laboratories and testing plants, efforts were directed toward the discovery of more efficient methods of breaking down domestic ores and for developing wider uses of known raw materials and new finished products in industry.

On the basis of promising results derived from the examination of more than 200 mineral deposits in 30 States and Alaska last year, Bureau engineers conducted 75 exploratory projects. Some success was reported in marking out added reserves of asbestos, mercury, copper, lead, zinc, iron ores, fluor spar, mica, feldspar, corundum, beryl, spodumene, and bauxite, as well as the ores of tungsten, nickel, and manganese. As a result of Bureau investigations new peacetime mining operations were established in nearly a dozen States for producing asbestos, mercury, lead and zinc, copper, iron, and feldspar. Aided by geophysical surveys, the Bureau marked out a potential magnetite ore body of the order of 375,000,000 tons in Utah

that ultimately may become the principal iron-ore reserve for the west coast industries.

In cooperation with mining operators, the Bureau developed new types of mining and drilling equipment and further evaluated the use of diamond drills in blasting and ore-breaking operations. Microseismic methods developed by the Bureau in the removal of pillar ore were supplemented by the development of a photoelastic and resistance strain gage for use in determining underground rock stresses.

Methods for the study of fault patterns in fluorspar areas were set up by the Bureau and assistance was rendered to the Government in grading stock piles of this material which contained some subgrade mineral. To utilize the vast deposits of North Carolina and the Pacific Northwest, the Bureau succeeded in extracting magnesia from olivine, offering a new source of magnesium and its compounds.

Of far-reaching importance to peacetime industries was the production of electrolytic chromium and electrolytic cobalt, as well as the development of processes for producing ductile titanium and zirconium. By producing these four additional highly pure metals, the Bureau supplemented previous well-known metallurgical work that gave industry electrolytic manganese and sponge iron, both of which have been widely accepted as valuable ferroalloy material. In connection with these latter metals, Bureau metallurgists found additional domestic ores suitable for the production of electrolytic manganese and devised additional ways of making sponge iron. With the age of jet-propulsion aircraft emerging from its infancy, pure metals produced under Bureau processes are expected to play an important role in the more rapid development of such craft. The need for metals suitable for high-temperature service, such as jet propulsion and gas turbines, was demonstrated by the Bureau in the operation of a pilot plant at Rolla, Mo., for the reduction of zinc ore with methane gas.

Through its geophysical work, the Bureau supplied Army engineers with information needed in Alaskan engineering projects and for the Alaska military highway. In one of the first surveys of its kind, the Bureau explored the continental shelf by geophysical methods and provided maps and other information to a Senate committee investigating domestic petroleum resources. Anticipating future explorations of these areas, which are believed to contain valuable potential oil, gas, and mineral deposits, the Bureau has outlined a prospecting plan to include extensive underwater surveys. In addition to taking a leading part in the development and testing of new apparatus, the Bureau also has been instrumental in checking new methods, such as magnetic surveys from an airplane, a wartime development of the Navy.

In the face of new problems arising from wartime developments in fuel production and the well-known complexities of fuel shortages which persisted last year, the Bureau's knowledge and long experience in fuel testing

served Government agencies, industry, and the public in wise conservation and efficient use of fuels and fuel-burning equipment. Technical advice also was given on types of equipment, fuel-testing and sampling, boiler corrosion, smoke-abatement measures, possible adaptation of foreign equipment to American mining methods, and safe storage of subbituminous coal. At the request of the Department of State, the Bureau furnished information on coal mining and preparation to several Latin-American countries. Still seeking new sources of coal suitable for coking, the Bureau determined that Colorado deposits are comparable or superior to the best previously tested western coals, offering a possible source of supply for the western steel industry. A new outlet was provided for the vast Northwest lignite deposits, which are suitable for reducing iron ores and for producing many chemicals and some materials needed in the manufacture of synthetic liquid fuels. Bureau fuel technologists detailed to other Government agencies added considerable information on foreign coal preparation and mining methods and hitherto unknown data on the production of synthetic liquid fuels. Extensive tests also were made on new equipment for use in anthracite mines and for bituminous-coal strip mines.

Designed as a wartime agency, the national fuel efficiency program that resulted in the saving of approximately 5 million tons of coal annually during the last 2 years of the war was concluded by the Bureau.

The lifting of restrictions on civilian use and the industry's desire to replenish war-depleted stocks kept the demand for petroleum and petroleum products near the wartime peak in the first peacetime year and proved a double incentive for the Bureau's efforts to increase the known petroleum reserves through more efficient recovery methods and the perfection of processes for making synthetic liquid fuels. New stimulative methods of oil production were investigated and laboratory research was intensified to produce suitable products from the less desirable crudes. Developing a method for minimizing or controlling equipment corrosion in gas condensate fields, the Bureau also isolated three pure sulfur compounds and offered some hope for converting high-sulfur crudes to more general commercial use.

As a natural sequel to previous work on the wartime production of aviation gasoline, the Bureau determined that crudes from at least 30 of the Nation's largest oil fields are suited for the production of jet-propulsion fuels, thus assuring a steady source of fuel supply when the need arises.

All of the major installations outlined in the Bureau's synthetic liquid fuels program became realities last year with the addition of a new gas-synthesis laboratory at Morgantown, W. Va., and a Government-owned ammonia plant at Louisiana, Mo., which is being converted into a 200-barrel-a-day hydrogenation plant. Construction work progressed on previously authorized units at Bruceton, Pa., for research on hydrogenation and gas synthesis; at Laramie, Wyo., for the development of oil-shale distillation methods; and at Rifle, Colo., for on-the-spot experiments with oil shale from

the nearby oil shale mine. Meanwhile, laboratory research and experiments on equipment design coupled with information from foreign sources indicate an encouraging reduction of production costs for the two proposed methods for making oil and gasoline from coal, lignite, and oil shale. During the construction of additional facilities, considerable experimental work both on design and processes has been accomplished at Pittsburgh, Pa., where the Bureau first established a small pilot plant many years ago to make synthetic gasoline from pulverized coal.

With the decline in military requirements for helium, the Bureau's production of this lightweight gas was reduced correspondingly last year, although additional sales to private users indicated an increasing peacetime market for the gas. Operating only four of its five plants, the Bureau easily met military and non-Federal demands for helium in wartime, producing 434,190,000 cubic feet of the gas in the last 6 fiscal years. As a conservation move to insure future supplies, more than half of the 63,403,345 cubic feet of helium produced in the fiscal year 1946 was returned to the underground storage reservoir established in the Government-owned Cliffside field at Amarillo, Tex. The war-built Cunningham, Kans., plant was closed last year, and the Otis, Kans., plant was placed in temporary stand-by status along with the Shiprock, N. Mex., plant. Helping to develop new peacetime uses for helium, the Bureau conducted an extensive test in using the gas as a tracer and encouraged wider use of helium in metallurgical work, for medical purposes, and in scientific studies.

The Bureau's health and safety programs, admittedly important in wartime, assumed more impressive significance last year as industry made increasing demands upon the Bureau for more first-aid instruction, expanded accident-prevention programs, and technical assistance for the prevention of explosions, roof-fall accidents, and elimination of health hazards in the mining and allied industries. Frequently revised to meet changing requests, Bureau standards were applied to coal mining, metal mining, and industrial plants with equal success. More than 19,000 persons were trained by Bureau engineers and safety instructors in first aid last year and about 4,000 received accident-prevention instruction. Bureau safety experts assisted at the 3 major mine disasters and investigated more than 50 other explosions and fires last year. Regulations in force during Government operation of bituminous-coal and anthracite mines added new responsibilities to Federal coal-mine inspectors, who examine more than 2,700 mines. In the course of these inspections, the Bureau analyzed more than 16,000 gas and dust samples and offered many recommendations for the reduction of hazards. Major improvements were effected voluntarily at many mines and continued improvement was reported in the mining industry as a whole. Bureau statistics showed that coal production in World War II was less costly in lives than in World War I. Special attention was devoted to flood preven-

tion and subsidence problems in the anthracite industry and further tests were made on the suitability of diesel locomotives for underground mines. Bureau laboratories continued the examination of mine equipment and materials for safety and also conducted special investigations on safe equipment design for use by the Navy. Of outstanding importance was the successful demonstration of a new underground communication system in the Bureau's experimental mine at Bruceton, Pa.

In connection with its studies on nonmilitary explosives for use by industry, the Bureau made hundreds of gallery and control tests as well as chemical examinations and brought the number of permissible explosives on its list to 180. Many special investigations were made for the Army and industry, and standards for the safe use of sheathed explosives and liquid-oxygen explosives were set up after exhaustive tests. Research involving the use of hydrogen peroxide as an oxidizing agent and development of equipment for measuring rates of detonation were completed by the Bureau. Technical advice on the disposal or industrial use of surplus military explosives in this country and at foreign bases was given frequently by Bureau personnel to the armed forces. Activities of the Explosives Control Division, which supervised the handling of millions of pounds of nonmilitary explosives during the war, were suspended in December 1945. In the 4 years of the program, the Bureau issued or reissued through volunteer workers more than 800,000 licenses in the 48 States and Alaska.

The retooling of industry to civilian production brought hundreds of new requests to the Bureau for economic and statistical information on minerals and basic facts on domestic and foreign production, stocks, distribution, and consumption. Some of the Bureau's statistical services were revised to incorporate features developed in wartime and a number of surveys conducted by war agencies were added to the Bureau's regular list. As rapidly as possible the Bureau published information previously withheld from general circulation, including foreign data and statistics on certain metals and strategic minerals. The Bureau's extensive files furnished much needed information to Government agencies in the disposal of surplus stocks and in the preliminary steps for stock-pile legislation. Employment figures and facts on the causes and frequency of accidents in the mineral industries were used in a variety of ways by numerous Government and private agencies in the industrial reconversion period.

Since the Bureau of Mines is primarily a technologic agency, an important function is the preparation of scientific reports describing various phases of research and investigation for distribution to the mineral industries and to the public. Last year the demand for technical papers, bulletins, reports of investigations, information circulars, and other publications continued at the usual high level. A considerable backlog of papers withheld during the war was released, and national technical societies called

upon Bureau staff members to write numerous papers. The educational motion picture program of the Bureau experienced an unusually successful year, nearly 8 million people viewing the films throughout the country. Four new pictures were completed with funds provided by sponsoring industries, and the library had a total of 10,952 reels at the close of the fiscal year. The films are loaned free to schools, colleges, training classes, scientific and engineering societies, and business and civic groups.

Summary of Activities

Mineral Development

As an aftermath of the war, the Bureau of Mines paused momentarily in 1945-46 to count the Nation's losses in mineral wealth—virtual exhaustion of mercury, platinum, and antimony; further depletion of its supplies of high-grade coking coal, high-grade iron ores, fluor spar, and copper; dwindling amounts of petroleum, zinc, lead, silver, gold, and high-grade manganese; and almost complete dependence upon foreign sources for nickel, chromite, tin, industrial diamonds, quartz crystals, flake graphite, and long-fiber asbestos.

On the more favorable side, the Nation came out with an overabundance of bituminous coal and lignite, low-grade iron ores, nitrogen, salt, phosphate rock, magnesium, and potash; comfortable supplies of anthracite and natural gas; ample but not profuse amounts of sulfur and molybdenum; and favorable prospects for the development of processes to break down low-grade materials heretofore considered submarginal.

Back on a peacetime basis, the Bureau of Mines concentrated its efforts toward the reestablishment of this Nation's mineral reserves through a broad program of research and investigations utilizing effectively the technologic developments made in the war years. Major research was continued at mining experiment stations at College Park, Md.; Tuscaloosa, Ala.; Norris, Tenn.; Pittsburgh, Pa.; Rolla, Mo.; Minneapolis, Minn.; Salt Lake City, Utah; Boulder City, Nev.; Berkeley, Calif.; Albany, Oreg.; Seattle, Wash.; and a newly established unit at Raleigh, N. C. Important work was conducted at pilot plants or field laboratories at Salisbury, N. C.; Rapid City, S. Dak.; Bauxite, Ark.; Laramie, Wyo.; Pullman, Wash.; and Redding, Calif.

In the fiscal year 1946, Bureau engineers operated on a less extensive scale than in wartime and examined 200 mineral deposits and conducted 75 exploratory projects on deposits in 30 States and Alaska. The value of such explorations has been strengthened by the fact that in many cases diamond drilling and other testing done wholly or in part by the Bureau of Mines have resulted in new firmly established peacetime mining enterprises. Notable among these are asbestos and mercury operations in Alaska; copper mining in Arizona and Vermont; lead-zinc in Idaho, Nevada,

Washington, and Wisconsin; iron in Utah; and fluorspar in Colorado and Kentucky.

Looking into the future of mineral prospecting in areas inaccessible to ground parties, the Bureau of Mines, at the request of the Navy, made a critical examination of the accuracy and value of magnetic surveys from an airplane. In comparing air and ground magnetic surveys conducted in Worcester County, Md., the Bureau indicated that the air survey method developed by the Navy can be improved greatly and made more effective by measuring the vertical magnetic intensity instead of the total magnetic intensity as practiced at present. In anticipation of more and more uses for geophysical work, the Bureau is prepared to make local and regional magnetic and electrical surveys and has established facilities for checking new methods, developing new geophysical techniques, and designing and developing new apparatus and equipment.

Pattern of work.—The mining and research investigations of the Bureau of Mines reached a peak during the last 2 years of the war because of the ever-increasing demand for scarce metals and minerals. Mineral investigations were expanded several times in size and in several new directions so designed as to be continued should the Bureau of Mines be called upon to engage in a continuing survey of the Nation's mineral reserves by stock-pile legislation. The Bureau's program as it evolved from the war consisted of 10 types of activity:

1. Examination of mineral deposits that appear from preliminary evidence to warrant investigation from the national viewpoint.
2. Geophysical investigation of promising areas that do not lend themselves to visual examination.
3. Probing and sampling of those deposits that examination and geophysical work indicate warrant it.
4. Analysis of samples obtained.
5. Testing of ores from deposits investigated to determine the most feasible treatment method.
6. Study of labor-saving and money-saving innovations in mining and milling methods.
7. Study of the state of the mineral industry and its future possibilities in individual mining districts.
8. Experimental work on methods of penetrating and sampling.
9. Experimental work on mining methods.
10. Experimental mining, with application of innovations, of parts of typical deposits in order to demonstrate the most effective methods of extracting hitherto unused ores from the ground.

In framing a pattern of mineral production and utilization in peacetime, the Bureau emphasizes the need for full knowledge of methods of mining and treating raw ores, particularly in the case of low-grade deposits that may be needed in time of emergency. During the war the ore-dressing work

of the Bureau was directed to especially needed materials that occur in this country only in very low grade ores, such as beryl, microlite, and spodumene, but new reagents and new techniques indicate more efficient recovery in peacetime ore-dressing practice for many common minerals. War experience demonstrated the necessity for complete pilot-plant study before commercial production starts, and although expensive, the pilot-plant work not only provides engineering information which permits the erection of commercial plants, but it also provides material which can be used by research institutions everywhere to demonstrate the value of a new and usually better product. In this manner, the Bureau will be able to bridge the gap between laboratory studies and commercial production more effectively.

To keep abreast with new developments in mining methods the Bureau's Mount Weather, Va., adit conducted comprehensive tests involving core-drilling rigs of various types, core-drilling equipment, bit coolants, cuttings-removal medium, properties of commercial diamonds, and optimum drilling conditions. Further developing its method for tamping blast holes that results in a saving of explosives, the Bureau experimented with stemming and shaped blasting charges.

In cooperation with various mining companies, the Bureau compiled and published additional information on the use of diamond drilling for blasting and ore breaking, particularly effective in a number of iron mines of the Lake Superior district. Several distinct advantages, including a greater safety factor, are cited in the use of diamond drills instead of the usual percussion type of drill.

Based on a process developed by the Bureau, private companies have adopted microseismic methods in the removal of pillar ore from large open stopes at an iron mine in Michigan and at a zinc mine in Tennessee. Another Bureau development—a photoelastic and a resistance strain gage method for studying stresses in mine models—is now in commercial use in connection with investigations of rock stresses in underground mines.

During the fiscal year 1946 some of the restricted reports on wartime mineral exploration and technologic advancements were issued and other publications are in preparation for the aid of the mineral industries and the public.

Iron, steel, and ferro-alloys.—Concentrating on the search for iron ores as well as related materials equally important in the manufacture of steel, the Bureau of Mines in the fiscal year 1946 renewed its efforts to produce high-purity metals and demonstrated several new uses for those already produced. Started before the war, the current work in reality marks a continuation of Bureau metallurgical research, which already has produced two pure metal products now widely known and used in commercial metallurgical processes—sponge iron and electrolytic manganese.

Previous experimental work supplemented by wartime technologic advances has resulted in the production of electrolytic chromium and electrolytic cobalt, as well as the production of ductile titanium and zirconium.

As a result of the Bureau's work and in view of the widespread technical interest already attracted, commercial production and extensive experiments on possible uses for these materials are anticipated.

Bureau engineers investigated occurrences of iron, tungsten, manganese, nickel, and fluorspar in more than 30 deposits in 17 States and Alaska during the fiscal year. Diamond drilling, trenching or tunneling work resulted in several successful projects warranting exploration of additional deposits. Iron-ore reserves, workable at some future time, were indicated in Alabama, Montana, and Washington, and a major deposit of tungsten of minable grade was outlined in Nevada.

Magnetic surveys were made for magnetite deposits in the Adirondack district at the Dannemora and Russia Station areas, in the Cranberry area of Avery County, N. C., and in Carter County, Tenn. In these latter 2 areas as many as 11 distinct ore bodies of minable size were indicated, most of which had no surface exposure or outcrops. Because of these newly discovered potential iron possibilities, this area may again come into production. The largest magnetite deposits discovered in the fiscal year 1946 have been in Iron County, Utah, around Iron Mountain, Granite Mountain, and the Three Peaks. The potential ore possibilities in this area have been estimated at approximately 375,000,000 tons and give promise of becoming the main iron-ore reserves for the war-built west coast steel industries.

High-purity ferro-alloy metals which only the Bureau has been able to produce in any substantial quantity have been in increasing demand in connection with experimental work being carried forward for the development of high-temperature alloys used in gas turbines and jet propulsion engines.

The Bureau pilot plant at Boulder City, Nev., making electrolytic manganese, distributed many tons of this material to the steel industry for cooperative investigations that resulted in the production of steels superior to or equally as good as those made with ferromanganese. Several additional domestic ore reserves proved amenable to the production of high-purity manganese under the Bureau's electrolytic process.

Expanding its electrolytic work, the Boulder City plant also produced electrolytic chromium from low-grade chrome ores of Montana and electrolytic cobalt from cobalt ores of Idaho. Details of these processes as well as methods for the production of ductile titanium and zirconium were released for the first time during the fiscal year 1946.

Electrolytic chromium, like electrolytic manganese, has yielded many valuable new alloys and its wide use in stainless steels and other chromium steels is freely predicted for the future. Electrolytic chromium is expected to eliminate some of the defects produced by the use of the present ferro-chromium, which contains some impurities. The process for using Montana chrome ores has completed the pilot-plant stage and is believed to be ready for commercial application.

In contrast to the hardness and brittleness of titanium, as it has been generally available, the pure metal produced by the Bureau is nearly as ductile as copper and can be rolled into thin sheets and drawn into fine wire. A light metal having only half the density of steel, titanium nevertheless is as strong as mild steel and as corrosion-resistant as stainless steel, suggesting its use in hundreds of ways both in the pure state and as an alloy.

Closely related to titanium, the silvery white zirconium has found commercial use in chemical engineering equipment and in important alloys. Substantial quantities of the pure zirconium, which is the basis of zircon sometimes used as a gem, have been produced at the Northwest Electrodevelopment Laboratory of the Bureau at Albany, Oreg.

In the hands of the metallurgist, cobalt is one of the most useful of metals and there is hardly an alloy that is not improved by the addition of cobalt. Because of its cost and the necessity of producing it from foreign ores, cobalt has not been used extensively in this country, but the Bureau's process for separating high-purity cobalt from the arsenical ores of Idaho promises to expand domestic use of the metal.

Although the Bureau many years ago firmly established the value of sponge iron in industry, pilot-plant tests at Laramie, Wyo., Minneapolis, Minn., and Salisbury, N. C., have demonstrated the possibilities of producing high-grade sponge iron in a variety of ways. The pilot plant at Redding, Calif., proved that high-grade steels can be produced effectively by using sponge iron and the electrolytic ferro-alloy metals. Further progress was made at the Northwest Electrodevelopment Laboratory at Albany, Oreg., in breaking down the complex nickel- and chromium-containing iron ores in Washington for the production of nickel-iron and nickel-iron-chromium alloys.

The development by the Bureau of a technique for determining fault patterns and locating the faults controlling mineralization has brought increased importance to the fluorspar areas of Crittenden County, Ky. Large mining operators are increasing their activity with the Bureau's help in the mineral development of the area.

Nonferrous minerals.—From a position of comparative self-sufficiency before the war in some of the nonferrous minerals—chiefly copper, zinc, and lead—the United States today is faced with greater dependence upon foreign sources for these materials and many others unless future discoveries or improved technology increases our known remaining supply. Conservative estimates place the domestic commercial reserves of mercury, cadmium, bauxite, vanadium, tungsten, platinum, mica, and antimony at less than a 10-year supply.

Some encouraging results were obtained from Bureau of Mines projects conducted in 15 States and Alaska during the fiscal year 1946. In the examination of 28 zinc and lead deposits and 5 copper deposits, Bureau engineers marked out important reserves of lead and zinc in Colorado,

Idaho, Kansas, Oklahoma, Washington, and Wisconsin; and equally promising deposits of copper were delineated in Arizona, Nevada, and Alaska. The Bureau examined 90 additional deposits of nonferrous minerals, but these projects were not developed.

Paralleling other experiments on the use of high-purity metals, the Bureau published additional information on research at the Salt Lake City, Utah, laboratory designed to establish the value of electrolytic manganese as a nonferrous metal. Likewise, the production of ductile titanium advanced to the pilot-plant stage, and extensive studies were made of both methods of production and the properties of the finished metal. This work was carried on both at Salt Lake City and at the Bureau's Boulder City, Nev., plant. Commercial production of ductile zirconium at a reasonable cost is anticipated as a result of the development of new techniques at the Albany, Oreg., laboratory.

Supplementing drilling, trenching, or tunneling with geophysical work, Bureau engineers prospected for copper reserves in the Elizabeth Mine copper area in Orange County, Vt.; in the Twin Buttes district of Pima County, Ariz.; and in the Mountain City area in Elko County, Nev. The same methods were applied in the search for zinc in the West Plains area of Missouri, as well as in the Copper Flats district of Grant County, N. Mex. Because most of the minerals used in the war had depleted the reserves of well-established mining operations, the Bureau made efforts to reestablish such well-known reserves. In this connection, surveys for lead were made in the Fredericktown lead area of Madison County, Mo., where buried hills of granite and related intrusives were indicated. Because lead deposition in this area is directly related to alterations in bedding and fractured zones, Bureau pilot research promises future results in this district.

Although some encouraging results were obtained in the operation of a pilot plant at Rolla, Mo., for the reduction of zinc ores with methane gas, the commercial success of this process depends largely upon the development of materials better suited for high-temperature service. The use of some of the high-purity metals already developed and now in production by the Bureau has been suggested for this purpose.

During the fiscal year, the gold and silver work of the Bureau which had been dropped during the war was resumed and greater efforts will be expended to bring about increased production of these metals. For almost a century the United States has been one of the world's leading producers of gold and silver, but the wartime inactivity and the decline in known commercial reserves may endanger this Nation's position in the production of these important metals.

Nonmetallic minerals.—Censorship rules preclude the revelation of complete details, but it now can be told that the Bureau of Mines had a small but important part in solving one of the many problems in the wartime work at the Oak Ridge, Tenn., project where the atomic bomb was perfected.

In addition to serving as a trouble-shooter, the Bureau's laboratory at Norris, Tenn., adjacent to the Oak Ridge plant, aided in developing ceramic porcelain insulators subject to heat shock needed in constructing certain important apparatus.

By diamond drilling and trenching in 5 States and Alaska, the Bureau developed 7 deposits of mica, feldspar, asbestos, corundum, or sillimanite and examined 60 additional deposits of nonmetallic minerals in various States. However, none of the seven projects developed produced encouraging results.

Of great interest to the building industries on the Pacific coast was the development of a process to utilize perlite, a siliceous lava containing magmatic water, for concrete aggregate and for thermal and sound insulation. When heated quickly, this material, long considered of little commercial value, is bloated into porous lightweight grains that serve the same purpose as bloating clays used in eastern building trades.

Further tests on sillimanite of South Carolina-Georgia have proved the value of this material for superduty refractory brick meeting both Navy and A. S. T. M. specifications. The most plentiful supply of the more prismatic form best adapted for this work is found in the Georgia section of the huge volume of material in a schistose zone 150 miles long.

To assist the Government in discarding subgrade mineral in stock piles of fluorspar the Bureau developed a process for eliminating unwanted materials, and the method has been adopted by a number of contractors. On the basis of a Bureau process perfected several years ago for separating feldspar from quartz and mica, several new mills are in prospect and the Bureau has extended assistance to potential operators. Some progress has been reported in a study of flake mica concentration in the Black Hills field office.

Light metals.—With the decline in demands for the principal light metals—aluminum and magnesium—the Bureau of Mines suspended virtually all of its exploratory work in this field during the fiscal year 1946, but continued the operation of a pilot mill at Bauxite, Ark., for the concentration of low-grade bauxites. Even with the decreased market for aluminum for industrial purposes, the Bureau has maintained its extensive metallurgical investigations for the production of alumina from domestic sources. Some of these investigations were continued in cooperation with semicommercial plants established by the Defense Plant Corporation. Results derived from wartime work would seem to justify the continuation of pilot-plant activities and the small-scale production of alumina from domestic ores so that techniques can be continuously perfected and a plant or plants made available for expansion should another emergency arise.

Among Bureau reports on light metals withheld during the war and issued last year were two describing the development of processes to salvage aluminum and magnesium from waste material such as pattern trimmings,

cuttings, aluminum dross, and fine magnesium dusts and skimmings and leavings of melting and refinery pots. In wartime, American plants monthly were discarding some 2,900 tons of aluminum containing about 9 percent recoverable metallic aluminum plus considerable aluminum oxide. Scrap or wasted material in wartime plants where magnesium was used in airplanes and in the manufacture of incendiaries and pyrotechnics in some instances amounted to about 35 percent of the weight of the finished products. Through Bureau-developed processes thousands of pounds of aluminum and magnesium ordinarily lost in processing were diverted back into war production.

Coincident with the Bureau's production of ductile titanium and zirconium has been the development of a possible peacetime outlet for additional supplies of magnesium. In the Bureau process for producing these highly pure metals at Albany, Oreg., magnesium is employed as the reducing agent. To supplement the Nation's reserves of magnesium, the Bureau has made progress in extracting magnesia from the mineral olivine. Tremendous deposits of olivine occur in North Carolina and the Pacific Northwest, providing a possible source of almost unlimited extent for magnesium and its compounds.

Geophysical explorations.—Definitely established in wartime as a valuable adjunct in mineral exploratory work, geophysical surveys using both magnetic and electrical methods are expected to serve an even greater purpose in future prospecting for minerals. Geophysical work in the war was not restricted exclusively to mineral explorations but also found application in war emergency projects related to the construction of air fields, buildings, and roads in Alaska. By the use of electrical methods it was possible to measure the depth to the top and bottom of permafrost, information which was required for certain engineering projects including the noted Alaska highway.

Throughout the war, geophysical methods were applied in the search for strategic and critical war minerals including copper, zinc, manganese, iron ores and magnetites, lead, and fluorspar. In addition, these techniques were employed in the quest for additional oil reserves. A magnetic survey of the Florida Peninsula outlined regions generally favorable for oil deposition and similar information was obtained in a survey of Washington County, Ala.

Probably the greatest contribution of geophysical work in the fiscal year 1946 was the exploration of the continental shelf bordering the United States and Alaska, since claimed by Presidential proclamation to a depth of 600 feet as United States territory. This area, approximately 750,000 square miles, contains oil, gas, and mineral deposits of a large potential economic value. With a considerable degree of certainty, preliminary Bureau studies indicate that there is a large potential oil reserve in the continental shelf in the Gulf of Mexico and that there also is a probable large

potential reserve of oil on the Arctic coast and the western coast of the United States. A large number of maps showing areas of the continental shelf were prepared by the Bureau for hearings before the Senate Special Committee for Investigating Petroleum Resources.

Since the exploration of the continental shelf up to the present time has been made possible solely by geophysical methods, the Bureau has prepared a careful plan embracing an organization particularly suited to underwater exploration for systematically surveying the entire area. Although private companies have done considerable work in off-shore exploration, little has been accomplished to establish methods for expanding the national petroleum reserves through the location of oil in unprospected areas of the continental shelf, as a part of its exploratory program, the Bureau of Mines is prepared to further such work.

Coal and Coal Product

Returning to peacetime research and technologic work on coal and economy and efficiency in governmental, industrial, and domestic fuel-using operations, the Bureau of Mines redesigned some of its programs to develop substitutes for overcoming the depletion of high-grade coal reserves and to solve new problems evolving from the wartime application of science in the production of different forms of fuel. A cooperative research program conducted by the Bureau and aimed to utilize the extensive lignite deposits of the Northwest demonstrated that both lignite and subbituminous coal can be used for beneficiating iron ores as well as for the commercial production of hydrogen or for the manufacture of synthetic liquid fuels and a wide variety of chemicals.

In maintaining its well-established fuel-testing and boiler-efficiency services, the Bureau of Mines continued to advise Government and industrial fuel users in the purchase and utilization of fuels and fuel-burning equipment, effecting substantial savings both in coal and in equipment costs. In providing such services, the Bureau tested more than 15,000 samples as a part of its safety program for the reduction of dust explosions, in connection with Government purchase and tippie and breaker inspections, and in the examination of coal and related materials in research work. An outstanding service was rendered by the Bureau in the determination of types of fuel and fuel-burning equipment for 37 new hospitals for the Veterans' Administration. With automatic stoking equipment returning to civilian production, new interest was evidenced in smoke abatement and the Bureau offered its services to several cities mapping smoke-curtailling programs.

To obtain the latest information unavailable during the war on European practice in the mining, preparation, and utilization of coal, five outstanding engineers of the Bureau were detailed to the Foreign Economic Administration to serve under the Technical Industrial Intelligence Committee

and another was detailed to secure information in Japan on low-temperature carbonization of coal. Records of hundreds of patents and documents were microfilmed and it is expected that the best developments uncovered in these surveys will be tested in the United States.

The conclusion of hostilities brought to an end the national fuel efficiency program, which had enlisted the aid of thousands of volunteer engineers and fuel users to conserve fuels and utilize equipment fully. Cooperating in the 2-year program were more than 16,000 individuals and the estimated savings reached the rate of 5 million tons of coal annually valued at some \$30,000,000 per year.

Coal mining and exploration.—Seeking more efficient methods for mining the remaining reserves of anthracite, the Bureau of Mines arranged for the testing of a new-type scraper-shaker-gangway loading machine and special shearing machines for use in mining the thin, steeply pitching beds of anthracite. Light earth-moving equipment for use in strip-mining bituminous coal was investigated and arrangements were made to study a unique coal planer found to be highly efficient in some underground mines of Europe. Extending its coal exploration work, the Bureau proved a deposit of 5 million tons of lignite in Washington minable at low cost by strip-mining methods. In the search for coking coal critically needed for long-term, economically competitive operation of the western steel industry, Colorado deposits tested indicated coal equal to the best previously known western coking coal. Exploration also was conducted in Alaska for coal necessary for regional use, in Alabama for coking coal, and in Maryland for highly desirable semismokeless coal of coking quality. More than 1,800 feet of drill cores from coal beds at seven exploration projects were examined and nearly 1,000 feet of coal from drilling were given detailed tests.

Gas- and dust-explosion research.—For the first time, Bureau of Mines research has made it possible to establish conditions for eliminating explosions in medium-pressure acetylene generators by adding prescribed amounts of hydrocarbons such as natural gas, propane, or butane to acetylene as it is produced in the generator. In extending the examination of industrial powders, dust, and vapor-air mixtures, the Bureau investigated minimum ignition temperatures and minimum spark energies for ignition, limits of inflammability, the use of helium or freon in explosion prevention, and prevention of gasoline and naphthalene explosions and aided in the scientific design of efficient burners.

Coal preparation and storage.—In the search for a low-ash, washed coal for the production of synthetic liquid fuels by the hydrogenation process, the Bureau of Mines examined coal seams in 11 States. The Bureau proved that some strip coal in Washington State, hitherto unmined, could be made marketable by washing. Investigations were made of thinner seams of coal in Maryland and Alabama, information on preparatory coal treatment was furnished to Alaska and several South American countries, a new process,

developed in Holland, for cleaning fine coal was investigated, and recoverable montan wax, previously imported, was found in lignite from Malvern, Ark., and Ione, Calif. Based on 4 years of study involving the use of 30,000 tons of coal, the Bureau proved that by using simple methods to prevent air circulation, subbituminous coal can be stored without danger of spontaneous heating and with little loss in heating value.

Coal combustion.—Continuing its research to prevent or minimize corrosion of boiler tubes, the Bureau of Mines developed a procedure for evaluating various protective tube coatings. To secure more efficient boiler design and increase the operating efficiency, the Bureau investigated heat absorption in large central-station boiler furnaces where work also was continued on testing coal-ash slag. Coal-ash slag tests proved useful in studying Rhode Island anthracite used in a slagging gas-producer designed to make rock wool as well as gas. The Bureau developed a test procedure to evaluate fuels from new processes and packaged fuels from various sources.

Coking and gasification studies.—Because war demands and the peacetime reconversion had depleted the supply of the Nation's best-known coking coals, the Bureau of Mines intensified its survey of carbonizing properties of American and some foreign coals with particular emphasis on the search for coals adapted to the making of metallurgical coke. Coking and by-product tests on three coals from Colorado and four from West Virginia indicated that coal from the Beckley bed of West Virginia might be suitable for blending with high-volatile coal in coking mixtures. Similar coking and byproduct tests were made on several South American coals for the Department of State. In studies on the use of lignite, the Bureau showed that gas suitable for the reduction of iron ores or manufacture of gas for the synthesis of liquid fuels could be made in externally heated alloy retorts.

Synthetic liquid fuels.—Contrary to expectations, this country's peacetime demand for petroleum and petroleum products remained at about the same level as the peak reached during the war, further emphasizing the importance of the Bureau of Mines program for producing synthetic liquid fuels from coal, oil shale, and other substances. As in wartime, the discoveries of oil in new fields during the reconversion period still fell far short of the annual needs of the Nation, indicating that the Bureau's synthetic fuel work will assume an even more vital role as the country's industrial activity increases.

The four major installations required in the Bureau's program under the Synthetic Liquid Fuels Act (Public Law 290) are now under construction and the preliminary progress in the entire program indicates that the United States is well on the way toward the development of processes of commercial applicability for producing oil and gasoline from the country's tremendous reserves of coal and oil shale.

Two processes are being studied at Pittsburgh, Pa., and nearby Bruceton, Pa., and at Morgantown, W. Va., on the research and development scale

for the production of oil and gasoline from coal. Equipment now in operation provides for producing and testing catalysts, preparation of coal, gases, and other raw materials from the processes and the operation of two complete units of equipment for the continuous synthesis of oil and gasoline from coal. Other synthesis units, producing up to about a barrel of oil a day, await laboratory space in new buildings under construction.

Breaking through one of the bottlenecks in the design and construction of large-size units of commercial equipment in the preparation of catalysts and in the removal of the heat of reaction, the Bureau made improvements that are expected to cut in half the production costs of one of the processes with prospects for substantial reduction in costs in the second process for making oil from coal.

Material savings in construction costs were effected by the acquisition of the Government-owned wartime synthetic ammonia plant at Louisiana, Mo., which will be converted to a demonstration plant to produce 200 barrels of oil daily by the hydrogenation of coal.

Laboratory development work on the production of oil from oil shale is being conducted in the petroleum and oil-shale experiment station at the University of Wyoming, Laramie, Wyo., and a demonstration plant for oil-shale work is being constructed on reserves held by the Navy near Rifle, Colo. This plant ultimately will produce about 500 barrels of oil per day, but is expected to start operation on a 50-barrel-per-day scale late in 1946.

Preliminary studies have indicated that oil in the United States Naval Oil Shale Reserves is equivalent to about three-fourths of the known petroleum reserves in the entire country. Because of many complex problems involved in refining oil from shale, the Bureau has concentrated on the determination and measurement of those properties of the shale that affect or control the conditions under which the oil should be removed. Completion of this work will make possible the designing of retorts for American oil shale on the basis of sound chemical and engineering data.

Petroleum and Natural Gas

Evolving from the war experiences and prewar work of the Bureau of Mines has been a threefold postwar program of conservation and better utilization of all the Nation's oil and gas resources by a comprehensive program of analysis and testing plus fundamental research into the properties of petroleum hydrocarbons. The broad objectives are designed to increase the primary recovery of oil through more efficient use of the natural energy in the deposits; to stimulate the recovery of oil from old fields by improved methods and increased operating efficiency; and to increase the utilization of marginal oils such as those of high sulfur content.

In 1946 the Bureau completed the last of a group of engineering studies for the Petroleum Administration for War on two important gas-condensate fields in Texas and issued several engineering reports previously restricted.

Additional field work was carried out in the Carthage field in Panola County, Tex., and engineering surveys were started in three new fields, including the important Ranglely field in Colorado. Although somewhat curtailed, the Bureau continued the collection and examination of sub-surface oil samples and the determination of bottom-hole pressures and temperatures in important new fields.

In cooperation with the Natural Gasoline Association of America, the Bureau investigated internal corrosion of production equipment in gas-condensate fields and, with an inhibitor developed by Bureau engineers, produced satisfactory control of corrosion in test wells in the Opelika field, Texas, and the Cotton Valley field, Louisiana.

Adding to information on stimulative methods of oil production and secondary recovery, the Bureau in 1946 published reports on operations in Illinois and Indiana and completed two reports on fields in Texas and Oklahoma. To help increase the recoverable reserves of the Nation, the Bureau investigated the plugging of the oil-producing formation around wells by the crystallization and deposition of salt and the bypassing of gas or water injected into the oil deposit in secondary recovery operations. In the Appalachian region Bureau engineers continued the development and application of a method of flowing small stripper wells instead of pumping them, thereby reducing operating costs and increasing recovery.

Because of the exceptional drain made upon oil reserves during the war, the Bureau's investigation of methods for economically recovering oil from large surface and near-surface oil-impregnated deposits assumed new importance and encouraging results were obtained in laboratory work in extracting oil from the Edna deposit of San Luis Obispo County, Calif. As a result of pilot-plant work, the Bureau proved the practicability of recovering microcrystalline wax distillate from tank-bottom settlings.

Shifting some of its research work on aviation fuels to the availability and quantity of crude oils of the United States suitable for producing fuels for jet-propulsion aircraft, the Bureau discovered that crude oils from 30 of the largest fields in the Nation were possible sources of jet-propulsion fuels.

For maximum utilization of all grades of petroleum, the Bureau intensified research involving superfractionation, desulfurization, silica gel absorption, hydrocarbon analysis, and engine testing of fuels. Three pure sulfur compounds, pentanethiol, thiophene, and ethyl sulfide, were prepared in the study of sulfur compounds and their effects in petroleum and petroleum products. These and other subsequently purified compounds will be made available to the petroleum industry through the Bureau of Standards. Precise thermodynamic constants were determined on 15 hydrocarbons and tetra-ethyl lead and plans were made to correlate the compositions of diesel fuels.

Helium

All-time helium production records were set repeatedly during the war as Bureau of Mines plants turned out an ever-increasing volume of this valuable lightweight, noninflammable gas for war purposes and for industrial and medical uses. Victory over Japan permitted the first release of statistics since Pearl Harbor and the output in the 6 fiscal years ended June 30, 1946, amounted to 434,190,000 cubic feet of helium. The peak production of 137,268,000 cubic feet was reported in fiscal year 1944.

In 1946, the Amarillo and Exell, Tex., helium plants produced 63,403,345 cubic feet of helium and of this total 203,500 cubic feet was used in experimental work and 32,143,045 cubic feet was injected into the underground storage reservoir of the Government-owned Cliffside gas field of Texas to conserve this Nation's helium reserves.

Reflecting increased private use of helium, the Bureau in 1946 set a new record in the sale of 4,249,125 cubic feet of helium to non-Federal users for industrial, scientific, and medical uses. To offset the decline in military requirements for the gas, the Bureau expanded its research program to discover new uses for helium and demonstrated its unusual value as a tracer in studying oil and gas reservoir conditions in the Elk Hills field, Naval Petroleum Reserve No. 1, in Kern County, Calif.

The defeat of Germany and improved conditions in the Pacific early in the fiscal year permitted curtailment of some of the Bureau's production program; the Cunningham, Kans.; plant, built wholly as a wartime expedient, was closed, and the Otis, Kans., plant was placed in stand-by condition along with the Navajo plant at Shiprock, N. Mex., which had been placed in stand-by status in March 1944.

Explosives Research

To safeguard life and property in the handling, storage, and use of explosives and inflammable substances, the Bureau of Mines set up safety standards based on accurate determination of hazards of static electricity and made many special investigations for industry and the armed forces. Testing more than 3,200 new permissible explosives and new types of industrial explosives utilizing surplus military stores, the Bureau added two new explosives to the permissible list which now includes 180.

To establish the limitations and conditions under which sheathed explosives may be used, the Bureau studied the hazards of toxic gases from these explosives and also made industrial tests on the performance and hazards of liquid-oxygen explosives. A study of the ignition of firedamp by explosives disclosed that the position of the detonator relative to the explosive charge plays an important part in the ignition process.

Special inquiries from industry and Government agencies resulted in work on the use of hydrogen peroxide as an oxidizing agent in explosives,

in the evaluation of hazards in specific industrial operations, and in devising a method for precisely measuring rates of detonation.

Further tests on the safe use of larger explosive charges at the Bureau's experimental coal mine have confirmed the desirability of continuing the 3-pound explosive charge limit for coal mining instead of the previous 1½-pound limit. Many special studies were continued in cooperation with the Army and the Navy and a member of the Bureau served on the Ordnance Department's Scientific Advisory Committee on Ballistics.

Safety and Health Activities

Released from the pressure of war production, the mineral industries gave more attention to industrial safety during the fiscal year 1946 as the Bureau of Mines again cooperated in offering multifold services in the advancement of health and safety activities.

Revival of interest in first-aid training programs and accident-prevention classes brought increased demands from industry for Bureau personnel in the promotion of safety education, accident investigations, material and electrical testing work, coal-mine inspections and reports, assistance at mine explosions and fires, and field and laboratory studies on the occurrence of gases, dust, temperatures, and other conditions affecting the health of mine workers.

To help solve serious problems resulting from mining in the anthracite region where the industry is financially unable to deal with them effectively, the Anthracite Flood-Prevention Section was transferred from the Fuels and Explosives Branch to the Health and Safety Branch at the beginning of the fiscal year and some progress has been made in aiding anthracite operators.

While the influence of the Bureau's many health and safety programs cannot be calculated precisely, it is acknowledged by the mineral industries that during the fiscal year 1946 scores of lives were saved and the damage of millions of dollars worth of property was prevented. These services would have cost the industry an estimated \$1,500,000 had such services been obtainable from private sources.

The safety, educational, and investigative work of the Bureau for more than 3 decades has constituted a valuable service to the mineral industries and could not be replaced by any means except by a similar national organization. Even with its already wide range in this field, the Bureau has been unable to respond to all of the requests from industry because of the lack of personnel. Expansion of the Bureau's first-aid training activities is of greatest importance for continued success and the many requests from organizations and industry concerning explosions indicate the need for more intensive research on the explosibility of gases and vapors. Demonstrations of various types of explosions of these materials were given in several States last year.

The Bureau's broad health and safety program is conducted in the field chiefly by the supervising engineers of the eight districts into which the country has been divided. In addition, there are eight subdistrict or field offices reporting directly to the district offices at Pittsburgh, Pa., Wilkes-Barre, Pa., Mount Hope, W. Va., Birmingham, Ala., Vincennes, Ind., Duluth, Minn., Dallas, Tex., and Salt Lake City, Utah. An important function of the supervising engineers is to correlate the entire program to operate efficiently and without duplication of work.

Although the Bureau of Mines coal-mine inspectors have no enforcement powers to insure the adoption of safety measures in coal mines under the Federal Coal Mine Inspection Act of May 7, 1941, the agreement of May 29, 1946, between the Secretary of the Interior and the president of the United Mine Workers of America, covering bituminous-coal and lignite mines during the period of Government possession, makes mandatory compliance with Federal recommendations based on the Federal Mine Safety Code, promulgated July 29, 1946. Furthermore, the Anthracite Wage Agreement of June 7, 1946, between the United Mine Workers of America and the Anthracite Operators provides that the "Operators and Mine Workers agree to accept such standards of safety adoptable and practical to the anthracite industry." These agreements placed an added responsibility on the Federal coal-mine inspectors and further emphasized the importance of their work.

Mineral-production security programs, including antisabotage work, were suspended at the beginning of the fiscal year and the Explosives Control Division, also a war agency that maintained close surveillance over non-military explosives used by American industries, was discontinued in December 1945.

Safety work.—Responding to industry's demand for expansion of safety programs initiated and stressed in wartime because of manpower and equipment shortages, the Bureau of Mines with its experienced safety engineers and instructors was responsible for first-aid training and mine-rescue instruction, recovery work at mine fires and explosions, investigations of mine accidents, testing and approval of safe mine equipment, research on new methods of underground communication, promotion of accident-prevention work, prevention of flood hazards in anthracite mines, and numerous special field and laboratory studies and services on safety in the mineral industries. Coincidental to the over-all safety program was the preparation and revision of coal-mine inspection standards, organizing and conducting of various courses of instruction, planning of publications on matters pertaining to mine safety, and staging of educational activities by means of motion pictures, lantern slides, and demonstrations.

During the year the Bureau instructed more than 19,000 employees of the mineral and allied industries in first-aid and mine-rescue work, increasing to approximately 1,625,000 the number of persons trained in these activities since the Bureau was established in 1910. Bureau personnel rendered

assistance at 16 first-aid and mine-rescue contests in various States last year. Providentially, only 3 major disasters—those in which 5 or more men were killed—occurred during the fiscal year 1946, but experienced Bureau safety workers were on hand to provide expert advice and aid in the arduous and dangerous rescue and recovery operations at these disasters as well as in the investigation of more than 50 other explosions and mine fires and some 70 miscellaneous accidents. In many instances, through the Bureau's efforts mining operations were returned to production with a minimum of delay.

In spite of limited personnel, the Bureau trained approximately 2,000 workers and officials in both coal- and noncoal-mining operations in accident-prevention and also instructed about the same number of employees in sections of the course considered applicable to their positions. Embracing both metal and other noncoal activities as well as the bituminous-coal-lignite-, and anthracite-mining industries, these accident-prevention courses were sought frequently during the fiscal year and procedures were kept up-to-date by engineers versed in coal and noncoal work.

Because falls of roof are responsible for more than half of the fatal accidents in all mining operations, the Bureau in its safety courses has stressed the prevention of roof fall accidents by adequate timbering or shoring methods, or prompt and safe removal of hazardous roof. Reflecting some progress in this work, Bureau statistics show that the accident rate from roof falls in coal mines is declining slowly, but in the metal-mining industry the rate appears to be essentially at a standstill. Although handicapped by limited funds and personnel, the Bureau will continue to place emphasis on this phase of instruction.

With the resumption of activities of the Joseph A. Holmes Safety Association, suspended during the war, Bureau personnel took part in the presentation of numerous safety awards to plants, supervisors and other individuals in all branches of the mining industry for outstanding achievements in safety. Maintaining contact with existent local chapters and district councils of the Holmes Safety Association, the Bureau furnished many speakers and exhibits for meetings of this auxiliary group.

Following rigid tests on explosibility, the Bureau gave official approval to 31 units of electrical equipment designed for safe operation in gassy mines, and extended the testing program to include trailing cables and certain other electrical equipment, resulting in some beneficial improvements. The Bureau continued certain confidential investigations on the design of safe equipment for use by the Navy Department. In connection with explosion hazards, the Bureau continued investigations on the explosibility of various dusts and powders and some of the Bureau's recommendations for the prevention and control of explosions and fires from such products have been incorporated in codes published by the National Fire-Protection Association.

Because of the increasing number of requests from noncoal-mine operators for electrical surveys similar to those made for many years in the Nation's

coal mines, the Bureau assigned an electrical engineer to this work, and on the basis of preliminary recommendations numerous electrical hazards have been eliminated. The Bureau also extended this work to include quarries and hydraulic and dredging mining operations with similar favorable results.

Investigative work that ultimately may lead to revolutionary changes in underground communication systems has been continued by the Bureau at its experimental mine at Bruceton, Pa., where it has been found that communication can be conducted through the strata for distances in excess of 1,200 feet without wires or direct connections between the underground workings to the surface. With further improvements on design, the Bureau plans additional tests in producing mines. The value of such equipment, if found practicable, cannot be overestimated for greater safety in day-by-day operation, but more definitely in recovery work when persons may be imprisoned underground after fires or explosions.

To help the anthracite industry, now threatened in many areas with inundation and subsidence, the Bureau has investigated feasible pumping facilities and methods of backfilling to prevent further destruction of mines. These projects will permit the mining of large reserves of anthracite found principally in the pillars remaining after first mining.

Coal-mine inspection.—In the first 4½ years of the administration of the Federal Coal Mine Inspection Act by the Bureau of Mines, the mining industry complied voluntarily with approximately 200,000, or 35 percent, of the thousands of safety recommendations made by Federal coal-mine inspectors, improving safety conditions and protecting millions of dollars' worth of mining property. Unquestionably, the coal mines of the Nation are in a much better condition with respect to safety of operation than they were before the advent of the inspection program and there is little doubt that the Bureau's work since the passage of the act in 1941 has been a large factor in bringing about the improved condition. It is significant to note that some States have taken steps to modify their mining laws to parallel in part the Bureau's inspection standards and procedures.

Hundreds of the improvements have been of a major character, such as changing from open to closed lights and from dangerous black blasting powder to permissible explosives, providing new openings for ventilation or escapement purposes, installation of new and more powerful ventilating equipment, and adoption of procedures necessary for gassy mines in numerous mines previously operated as nongassy.

Increased attention to safety and the many voluntary improvements in mining operations resulted in a continuous reduction in the frequency rate of fatal and nonfatal injuries which dropped from 75.90 in 1941 to an all-time low of 66.77 in 1945. In the fiscal year 1946, only 3 major coal-mine disasters occurred and in these only 51 men were killed, in contrast to the 18 major disasters and 919 deaths in the coal mines of the United States in 1907. These performances were achieved in the mining industry in

spite of continued heavy demands for coal coupled with the many adverse operating conditions brought about by the war.

During the year, Bureau safety experts inspected and reported on safety conditions at 2,719 mines, 320 of which were examined for the first time, and 2,399 reinspected. Virtually all of the mines of the United States employing 25 or more men have been inspected several times and the wide acceptance of the Bureau's safety proposals has been reflected in the many improvements listed in the consecutive inspection summaries. Of the approximately 7,000 regularly producing coal mines in the United States, safety inspections have been made at 3,260 operations, but these represent about 99 percent of the coal produced in 1945 and the remaining 3,740 mines, many employing less than 25 men and not generally inspected, account for only about 1 percent of the Nation's coal output. Included among the mines inspected last year were many small operations employing fewer than 25 men on public domain and Indian lands examined in accordance with a previous order from the Secretary of the Interior.

In carrying out the Federal inspection program last year, the Bureau had a field force of 157 coal-mine inspectors, 5 mining-explosives engineers, and 5 mining-electrical engineers. Although this force performed exceptional service, a staff of at least 250 is needed to give adequate rigid inspections to the thousands of larger mines annually. Some progress toward this goal already has been made as the Congress appropriated funds to provide for the employment of 25 additional inspectors during the fiscal year 1946, and for 45 more inspectors during the fiscal year 1947.

A significant comparison is shown by statistics on coal-mine fatalities during World Wars I and II. Notwithstanding the numerous handicaps in mining in the last war, enormous pressure for maximum production of coal resulted in record-breaking performances by the industry. In the war years 1942-45, which coincided with the first 4 years of the Federal coal-mine-inspection program, the unprecedented total of 2,608,000,000 tons of coal was produced at a cost of 5,314 lives, the fatality rate being 2.04 deaths per million tons of coal produced. During 3 years of World War I, 1916, 1917, and 1918, when there was a similar demand for coal, the production was 1,919,000,000 tons with a total of 7,502 deaths, or a fatality rate of 3.91 deaths per million tons of coal produced. Thus, the United States obtained its urgently needed coal in World War II at a cost of 4,720 fewer lives than if coal-mining fatalities had been at the rate of World War I.

Explosives regulation.—Invoked with the Declaration of War on December 8, 1941, Federal regulations governing nonmilitary explosives were relaxed on October 9, 1945, eliminating the licensing provisions of the Federal Explosives Act. The Explosives Control Division was liquidated by the Bureau in December 1945, after successfully supervising transactions covering millions of pounds of explosives used in wartime by American industries.

Attesting to the efficacy of the Bureau controls, no clear-cut cases of sabotage involving explosives and blasting materials were reported to the Bureau in nearly 4 years of management of the program. Through the Bureau's efforts, hundreds of improvements were effected in the storage, transportation, and use of explosives.

In administering the Federal Explosives Act through nearly 4,000 volunteer licensing agents serving without pay, the Bureau inspected more than 40,000 explosives-storage magazines and issued or reissued about 800,000 licenses in the 48 States and Alaska, authorizing more than 300,000 persons or organizations to transact business in explosives. Only 56 licenses were revoked throughout the war years, and many of these revocations were attributed to ignorance of the provisions of the act and its regulations.

Health work.—Focusing attention on the conservation of human resources with the attending benefits of improved morale of the worker and increased efficiency of operation in the mineral and allied industries, the Bureau of Mines achieved these objectives with a broad over-all program that included investigations of unhygienic conditions in coal, metal, and nonmetal mines, naval foundries, and steel and aircraft plants, studies of underground operation of diesel mine locomotives, new advances on ventilation and air-conditioning of mines, better understanding of the physiological effects and controls of atmospheric contaminants, testing of respiratory protective devices, compilation of data on acid mine drainage, and laboratory analysis of noxious gases produced by the decomposition of cable insulation and plastic materials used in electrical equipment.

In conducting these diversified investigations and inspections of coal mines, the Bureau analyzed more than 16,000 gas and dust samples, entailing more than 100,000 individual determinations in the fiscal year. By careful study of analysis reports, Bureau safety engineers and inspectors were able to ascertain the relative danger of concentration of toxic or explosive gases and to offer suitable recommendations to correct hazardous conditions. In analyzing air samples from sealed fire areas, the Bureau determined not only the effectiveness of the seals but also the progress of the extinguishment of the fires, thus expediting recovery and rehabilitation operations with minimum hazard in the affected mine areas.

From preliminary tests on the operation of diesel mine locomotives in haulage in a number of underground metal, clay, limestone, and sand mines, the Bureau indicated that with reasonably good ventilation and approved operating procedures and maintenance, diesel engines of a suitable design may be used in mining operations without creating hazardous or unduly objectionable conditions in the air of working places. Bureau conclusions were based on the experiences of mine operators using diesel-powered equipment, analysis of exhaust gases for toxic and objectionable content, ventilating and mining methods, and properties of diesel fuels.

Because of its well-established approval program, the Bureau of Mines has been considered an outstanding authority on respiratory protective

devices and many requests were supplied from industrial, governmental, and other organizations for information on the performance, selection, limitations, and use of such equipment.

The detailed surveys of unhygienic conditions in mines and mining, metallurgical, and petroleum plants together with laboratory studies on the determination and control of atmospheric contaminants have been beneficial in improving working conditions for thousands of industrial workers and also have increased the Bureau's already extensive information files on such subjects. In disseminating this information by publications, conferences, talks, and exhibits, the Bureau has been of material assistance to industry in instituting, developing, and maintaining programs to improve working environments.

In cooperation with the Bureau of Ships of the Navy Department, the Bureau conducted investigative work to determine the performance characteristics of several gas-indicating instruments. To evaluate possible hazards from toxic gases liberated from the burning and thermal decomposition of thermosetting synthetic resins, the Bureau has tested this material and has provided some insight into recent developments in this field.

By the development of a psychrometric chart, now ready for publication, the Bureau furthered its analysis of problems in mine air-conditioning and started a study of heat and moisture changes in airflow circuits of hot deep mines. Information on mine ventilation and fluid flow was supplied to Bureau engineers, mine operators, and others.

Because of the renewed interest in stream pollution, the Bureau has strengthened its investigations on acid mine drainage and has made some progress in developing the analytical procedures for evaluating the qualities of acid mine water which will be helpful in more efficiently applying corrective measures.

Economics and Mineral Industries

The ending of hostilities early in the fiscal year 1946 brought about a rapid conversion of the economics and statistics services of the Bureau of Mines, geared to meet an anticipated heavy demand during the reconversion period of basic information on minerals needed by the Government, industry, and the public. The end of the war permitted a substantial reduction in both the frequency and detail of many monthly statistical surveys which had provided invaluable information on production, stocks, distribution, and consumption of minerals for the guidance of industry and Government during the war. Surveys on metals and nonmetallics, particularly, were revised, but simultaneously the Bureau undertook certain surveys previously conducted by the War Production Board. In view of the continued short supply of fuels in comparison with requirements, special surveys on bituminous coal and anthracite were continued throughout the year for the Solid Fuels Administration.

Strengthened by the knowledge that the war had clearly demonstrated the need for national supplies of strategic and critical materials not available in adequate quantities from domestic sources, the Congress late in the fiscal year 1946 completed action on legislation authorizing the stock piling of these materials, ending a long controversy emphasized by the depletion of some of this Nation's mineral reserves. Because of work already accomplished during the war years in collection and dissemination of mineral statistics, the Bureau was able to refashion some of its reconverted fact-finding services to provide the basic data needed in the administration of the stock-piling act.

Although handicapped by curtailed funds with which to expand its foreign mineral services on an adequate basis, the Bureau in cooperation with the State Department made progress in drafting a program fitted for the administration of this act. However, further expansion is needed in the future in order to supply the Government with adequate information on the available supply of minerals of foreign origin.

In the modification of statistical services of the Bureau, pressing postwar problems of mineral supply and development were undertaken and progress was made in the development of economic data on domestic production and utilization of minerals for use in special studies on regionalization, mineral taxation, transportation, and other factors on the conservational use of mineral resources.

Technical services of the Bureau still were much sought after to fill an ever-increasing demand for mineral specialists to serve on numerous departmental committees and other groups dealing with national and international mineral problems.

Metals.—In keeping with the industrial transition from war to peacetime production in the fiscal year 1946, the metal-reporting services of the Bureau of Mines were readjusted rapidly to problems arising from the sharp declines in war production offset only slightly by increasing civilian production. Fortunately no drastic readjustments were required because in general the metal-reporting services developed during the war do not differ greatly from the Bureau's traditional peacetime activity.

In order to maintain the continuity of wartime metal reports, some canvasses conducted regularly in the Bureau's well-established reporting service were revised to include desirable features of reports issued by war agencies before their emergency functions were suspended. On the basis of experience gained in wartime, the Bureau redesigned canvasses and reports to shift the emphasis to all industrial minerals in contrast to the heavy emphasis on strategic and critical minerals during the war.

Because of the many complex problems arising from the disposal of Government-held inventories of metal and scrap and other surpluses, the Bureau was able to furnish up-to-the-minute factual information for the guidance of agencies charged with the disposal of property. In addition, Government agencies relied heavily on the Bureau's services to assist in

price stabilization, the distribution of still scarce commodities, industrial reconversion, and the acquisition of strategic materials for permanent stock piling.

Much information developed during the war was held confidential for security reasons, but these data now have been summarized and published in conjunction with the usual monthly, quarterly, or annual reviews, supplemented by new consumption and nonferrous scrap metal surveys.

Nonmetallics.—Retaining in modified form some of its special services initiated during the war, the Bureau of Mines during the fiscal year 1946, as in past years, compiled and distributed regularly monthly and quarterly reports on commercially important nonmetallic minerals and their primary products. Of special peacetime interest to the building, chemical and fertilizer industries—as well as many other industries—was the compilation of a 21-chapter statistical review of nonmetallics for the Bureau's authoritative Minerals Yearbook.

For the first time in more than 4 years, Mineral Trade Notes, which had been issued monthly as a confidential series during the war, again was made available to the public. These Mineral Trade Notes, consisting chiefly of abstracts of consular and other reports, proved highly valuable to Government and war agencies in locating needed nonmetallic minerals.

Drawing upon its extensive and constantly growing files, the Bureau of Mines prepared many special studies in response to thousands of questions on nonmetallics from industry and individuals and continued to furnish essential data to Government and private industry during the reconversion period. Special reports were compiled on barite, graphite, tripoli, and the cement industry of the Latin American countries.

To encourage the preparation and distribution of more and better literature on nonmetallics, the Bureau undertook special work in cooperation with such organizations as the American Institute of Mining and Metallurgical Engineers and the Society of Economic Geologists.

Two Bureau of Mines experts in nonmetallics were drafted for responsible duties in occupied territories of enemy countries, one to serve in Europe as a scientific consultant under the Field Information Agency, Technical, of the War Department, and the other in Japan under the Military Geology Unit of the Geological Survey detailed to the Army Engineers Corps.

Petroleum and natural gas.—The war's almost insatiable demands for petroleum products served to emphasize further the long-range aim of the Bureau of Mines in maintaining complete information files on domestic and international supply and consumption of these important products so indispensable in war and peacetime alike. Filling in many of the gaps occasioned by wartime censorship on the dissemination of current statistics on the production and distribution of crude petroleum and petroleum products, the Bureau early in the fiscal year 1946 prepared and released several publications supplying domestic and foreign statistics on these commodities withheld from the public during the war period from 1941 through 1944.

The International Petroleum Trade, listing monthly petroleum inventories as secured from Government Foreign Service offices and other sources, was returned to public distribution in October 1945, and a month later the Bureau resumed public issuance of monthly forecasts of estimated crude demand by States of origin which during the war had provided the Petroleum Administration for War with such a valuable gage for determining desirable rates of production. In addition to regular weekly, monthly, and quarterly reports, the Bureau inaugurated a quarterly forecast of demand for crude oil and major petroleum products, this report to be supplemented with longer term forecasts as a regular function of the Bureau.

Although some revision was made in the number of Bureau crude petroleum and petroleum products reports, experiences suggested by the war demonstrated the need for additional changes and the Bureau continued its objective for serving industry and the public by securing industry advice and assistance in improving its fact-finding program.

Coal.—Because of acute regional shortages and the continued unprecedented demand for fuels, coke, and special-purpose coals, detailed information of the Bureau of Mines based on long-time studies of bituminous coal, anthracite, lignite, and other solid fuels and byproducts proved highly valuable in insuring an equitable distribution of the available supply. Well-established statistics of the Bureau on requirements, production, shipments, and uses of these commodities were indispensable instruments in carrying out the distribution and pricing programs of the Solid Fuels Administration, War Production Board and its successor, the Civilian Production Administration, the Office of Price Administration, and other Government agencies dealing with solid fuel needs in the reconversion period.

Increased wages resulted from the reopening of wage contracts and Government agencies relied heavily on Bureau statistical data in computing allowable increases under the Government wage formula and in arriving at higher average selling prices to offset the consequent upswing in labor costs and the rise in other expenses of operation. Trained personnel and statistical records and facilities of the Bureau all were made available in working out the cost and price adjustments.

With the establishment of the Coal Mines Administration to operate mines in the possession and control of the Government, pertinent statistical and other records required by that agency were provided and trained Bureau personnel assisted in conferences on technical matters.

To supplement the well-established weekly, monthly, and annual reports published by the Bureau, a new series of reports on distribution of bituminous coal, for 12-month periods ending quarterly, was instituted and some surveys, particularly those concerning the distribution of bituminous coal, anthracite, and lignite, were expanded during the fiscal year.

Foreign minerals.—Failure to receive adequate funds hampered the efforts of the Bureau of Mines to extend its facilities for obtaining foreign statistical and other economic data as provided for by Public Law 48, approved

May 3, 1945. Under legislation sponsored by the Department of State, the Bureau of Mines proposed to supersede the wartime Minerals Attaché Service by establishing 18 regions throughout the world and assigning competent technical specialists to the United States Foreign Service to aid this Government on problems relating to supplies of mineral raw materials.

The Bureau has under consideration a proposal to expand its activities in Latin American countries by providing mining and metallurgical technical assistance to Mexico similar to that already being provided to Brazil at the request of the Department of State under its cultural relations program.

Declassification of the Foreign Minerals Survey series which formed the basis of much foreign statistical data during the war permitted general distribution of comprehensive reports on the mineral resources of Japan, Latin America, Spain, and Hungary.

Accident and employment data.—With mine safety becoming an increasingly important economic consideration, Bureau of Mines injury statistics on the mineral industries became correspondingly important to serve as an unbiased measure of mining hazards on a common basis. Among many requests supplied from the Bureau's files and records were special compilations of coal-mine accident statistics and exposure-to-hazard data for use in connection with bituminous-coal wage negotiations late in the fiscal year.

In revising some of the established annual reports, the Bureau issued for the first time injury rates for certain metal-mining industries on a tonnage basis and productivity per man-hour of work and reassembled metal and nonmetal accidents statistics in well-defined industry groups on both regional and countrywide bases. Virtually completed were the compilation of injury-severity rates for coal-mine accidents and the revision of coal-mine injury rates per million man-hours to include portal-to-portal time, thus establishing a total exposure basis for the first time.

Government and private agencies directly concerned with labor problems continued to apply Bureau of Mines employment figures for the mineral industries in a variety of ways and the confidential monthly series on coal-mine employment was continued on a State-wide basis because of disturbed conditions in the solid fuels industries. In continuing surveys on industrial explosives, the Bureau supplied details on the constituents and consumption of these materials to the armed forces, foreign economic missions and those regularly interested in the industry.

Public Reports

With continuing demands from industry, Government agencies, and the public for informative material on subjects associated with the mineral industries, the volume of publications prepared and issued by the Bureau of Mines in 1946 remained at the high level typical of the war years. A considerable backlog of scientific papers and reports, withheld for various reasons during the war, was released for publication. Several of the na-

tional technical societies resumed their annual meetings after the war and Bureau staff members were called upon to write numerous articles and reports for these societies.

In all, there were 541 publications issued, either as printed or processed material, requiring the editing of about 21,500 pages of manuscript, reading proof, making indexes, and preparing 2,250 illustrations. These publications included 96 printed publications such as bulletins, technical papers, miners' circulars, data books, and Minerals Yearbook chapters; 197 mimeographed reports of investigations and information circulars; 205 papers and speeches for the technical press; and 43 miscellaneous manuscripts, together with numerous brief periodic statistical reports for the industry.

As a technologic agency with the responsibility of keeping the minerals industry and the public informed of trends and developments in mining, metallurgy, health and safety, and related fields of work, the Bureau continued to carry out its policy of the widest possible dissemination of its technologic, economic and scientific information. Nevertheless, the number of copies of each publication printed and distributed was restricted to the minimum to save funds and material.

With 2,863 books and pamphlets and 236 volumes of bound periodicals added during the year, the Bureau's Washington library of selected reference material now has a total of 65,061 items. At the year's end, 320 periodicals had been received and recorded and 228 of them were routed regularly to staff members. Outside of the library, 23,980 periodicals and books were lent or routed. Nearly 5,000 people came to the library to use material and there were approximately 4,000 telephone inquiries. A total of 2,770 books were cataloged and 8,000 cards were added to the card catalog.

The educational motion picture program of the Bureau of Mines enjoyed one of the most successful years since its inception more than 25 years ago. The films, distributed free to schools, colleges, training classes, engineering and scientific societies, and business and civic groups, are produced under the supervision of the Bureau and paid for by private industry. There is no advertising in the films, and the sponsor's name appears only at the beginning and end of each picture.

Last year the Bureau's educational films were shown on 92,934 occasions to audiences totaling 7,893,218 persons. As of June 30, 1946, the Bureau's film library had 10,952 reels in circulation, with a total footage of 4,258,456 feet. During the year the Bureau added 563 sets of pictures, consisting of 1,500 reels, to the library.

Four new pictures in 16-millimeter sound were completed and released for showing in 1946. They were *The Story of Texas and Its Natural Resources*, *The Evolution of the Oil Industry* (revision of an earlier film), *The Story of Arc Welding*, and *Tin from Bolivia*.

The Texas State film, which met with wide acclaim throughout the country, appears to be the forerunner of a series of State films. The Bureau has

received numerous requests from prospective sponsors of similar films, and two more State pictures—on Oklahoma and Ohio—are in varying stages of production and are expected to be released during the 1947 fiscal year.

Administration

As in past years, activities of the Bureau of Mines were administered from Washington, D. C., but carried on largely in the field offices, laboratories and pilot plants. In order to administer more effectively the problems arising in connection with wages of unclassified employees, arrangements were made to handle rate determinations by wage boards organized on a regional basis.

Personnel.—On June 30, 1946, there were 3,375 full-time employees in the Bureau of Mines, distributed as follows:

Classification and number of appointees

	P & S	SP ¹	CAF	CPC ²	Total
Department.....	138	1	501	14	654
Field.....	865	344	653	859	2,721
Total.....	1,003	345	1,154	873	3,375

¹ Includes instrument makers, safety instructors, laboratory aids, assistants, etc.

² Includes laborers, mechanics, messengers, wage employees, etc.

Property.—As of June 30, 1946, the property of the Bureau had a total valuation of \$12,094,641.98, of which \$3,157,089.14 was for land, buildings, and improvements; \$3,066,080.29 for laboratory equipment \$2,780,-691.24 for machinery and power-plant equipment; and the remainder for automobiles and trucks, office furniture and equipment, rescue cars and specialized apparatus, and other goods.

Finance.—The total funds available to the Bureau of Mines for the fiscal year ended June 30, 1946, including direct appropriations, departmental allotments, reappropriated balances, and sums transferred from other departments for service work, were \$25,301,457. Of this amount \$17,250,-648 was spent, leaving an unexpended balance of \$8,050,809. On the regular work of the Bureau, \$16,009,760 was expended. These figures are subject to revision because of unpaid obligations.

Table 1 presents classified information regarding the financial history of the Bureau for the fiscal years ended June 30, 1943-47.

Table 2 gives a statement of the distribution of congressional appropriations to the services and divisions and the expenditure of these funds in 1946 by Bureau divisions.

TABLE 1.—Bureau of Mines appropriations and expenditures, fiscal years ended June 30, 1943–7

Fiscal year	Appropriated to Bureau of Mines	Departmental allotments ¹	Funds transferred from other departments ²	Total funds available for expenditure	Unexpended balances	Total expenditures	Expenditures, exclusive of service items ³
1943-----							
1944-----	\$28,707,630.94	\$106,450	\$2,587,615.28	\$22,168,548.20	\$5,851,568.64	\$26,316,981.56	\$25,178,429.84
1945-----	20,969,098.00	91,300	3,460,898.00	\$25,476,222.00	5,654,660.00	19,821,562.00	17,962,000.00
1946-----	22,195,136.55	91,500	6,290,167.74	28,988,520.00	8,556,166.67	20,432,353.33	19,656,644.67
1947-----	17,846,838.69	6,500	2,384,271.00	7,25,301,457.69	8,060,809.69	17,260,648.00	16,009,760.00
1947-----	16,000,515.00	7,800	457,416.00	\$20,099,801.12			

¹ Includes printing and binding, stationery, and contingent funds.² Includes proceeds from sales of residue gas.³ Service items include helium, and other investigations and services for other departments.⁴ Includes \$976,885.27 unexpended balance reappropriated, and balance of \$128,018.51 receipts from sale of helium and other products.⁵ Includes \$4,606,720.72 unexpended balance reappropriated, and balance of \$202,723.66 receipts from sale of helium and other products.⁶ Includes \$4,603,644 unexpended balance reappropriated, and balance of \$291,152 receipts from sale of helium and other products.⁷ Includes \$4,678,164 unexpended balance reappropriated, and balance of \$385,684 receipts from sale of helium and other products.⁸ Includes \$3,176,386.12 unexpended balance reappropriated, and balance of \$457,684 receipts from sale of helium and other products.⁹ Includes stationery and contingent funds.

TABLE 2.—Bureau of Mines expenditures, fiscal year 1946

Division or branch	Salaries and expenses	Operating rescue cars and stations and investigation of accidents	Coal-mine inspections and investigations	Salaries and expenses, enforcement of Federal Explosives Act	Testing fuel	Anthracite investigations	Synthetic liquid fuels	Mineral mining investigations	Oil and gas investigations	Expenses mining experiment stations	Care, etc., buildings and grounds, Pittsburgh, Pa.
Office of the Director	\$42,082										
Office of Minerals Reports	5,207	\$19,738	\$37,028		\$9,417	\$3,242	\$298			\$26	
Total	48,289	19,738	37,028		9,417	3,242	45,209		\$2,438	2,733	
Administrative Service											
Mining Branch	57,553	16,445	12,872	\$5,408	9,627	22	77,697	\$36,750	28,784	34,880	
Metallurgical Branch	1,349							13,410		112,083	
Fuels and Explosives Branch:	7,426							212,623		730,974	
Coal Division	8,660	185,373	52,632		299,140	35,775	103,007			60,061	\$161,282
Explosives Division		132,281									
Petroleum and Natural Gas Division	1,412								546,544		
Synthetic Liquid Fuels Division											
Total	10,072	317,654	52,632		299,140	35,775	5,453,494		546,544	60,061	161,282
Economics and Statistics Branch:											
Coal Economics Division	2,017										
Foreign Minerals Division											
Metal Economics Division	36,923		4,445								
Accident Analysis Division	2,088		16,170								
Nonmetal Economics Division	774										
Petroleum Economics Division	70										
Total	41,842		23,615								
Health and Safety Branch:											
Coal Mine Inspection Division	2,720		922,749								
Safety Division	4,917	430,090	20,194								
Health Division	193	61,667	57,894			26,165					
Explosives Control Division				66,600							
Total	7,830	491,767	1,000,837	66,600		26,165					
Total appropriations	175,200	846,000	1,127,240	72,100	320,000	66,000	9,403,399	417,700	579,000	962,200	161,750
Total expenditures	174,301	845,594	1,126,984	72,068	318,193	65,204	6,576,360	414,813	577,766	960,757	161,282
Balances	899	406	256	32	1,807	796	13,827,039	2,887	1,234	1,443	468

Division or branch	Econom- ies of mineral in- dus- tries	Investiga- tion of raw material resources for steel production	Construc- tion and equipment of helium plants	Manganese benefici- ation pilot plants	Produc- tion of alu- minum from low-grade bauxite, aluminum clays and alumina	Investiga- tion of bauxite and alu- mina ores and alumi- num clay deposits	Magne- sium pilot plants and research	Investiga- tion of de- posits of critical and essential minerals in the United States and its posses- sions	Helium utiliza- tion and research	Helium pro- duc- tion	Reduction of zinc con- centrates with methane gas
Office of the Director	\$18,514	\$19,386			\$2,491	\$52	\$1,076	\$23,436			
Office of Minerals Reports		10,386			2,491	62	7,962	23,436			
Total	18,514	33,308									
Administrative Service	50,944	441,614	\$5,279	\$18,717	20,646	22,109	8,418	56,797	\$1,243	\$31,007	
Mining Branch		644,002		379,818	424,019	125,610	229,532	1,032,368			\$74,324
Metallurgical Branch											
Fuels and Explosives Branch:											
Coal Division		26,718						298,091			
Explosives Division			165,871						75,082	440,784	
Petroleum and Natural Gas Division											
Synthetic Liquid Fuels Division											
Total		26,718	165,874					298,091	75,082	440,784	
Economics and Statistics Branch:											
Coal Economics Division	150,824										
Foreign Minerals Division	78,658										
Metal Economics Division	216,605										
Accident Analysis Division	55,720										
Nonmetal Economics Division	69,117										
Petroleum Economics Division	52,326										
Total	631,630										
Health and Safety Branch:											
Coal Mine Inspection Division											
Safety Division											
Health Division											
Explosives Control Division											
Total											
Total	705,000	1,070,000	814,627	400,000	430,000	150,000	250,000	1,680,000	78,400	2,903,528	77,506
Total appropriations	701,118	1,065,028	171,153	398,535	417,156	147,771	245,912	1,667,028	76,925	471,791	74,324
Total expenditures		4,972	1,673,471	1,465	2,814	2,229	4,088	712,972	1,475	12,631,557	13,952
Balance	3,882										

TABLE 2.—Bureau of Mines expenditures, fiscal year 1946—Continued

Division or branch	Drainage tunnel, Leadville, Colo.	Development and operation of helium properties (special fund)	Salaries and expenses, Solid Fuels Administration for War	Working funds	Cooperation with the American public	Contingent expenses	Total
Office of the Director.....			\$141				\$14,506
Office of Minerals Reports.....			10,381				206,010
Total.....			10,525				250,516
Administrative Service.....							
Mining Branch.....							549,285
Metallurgical Branch.....			23,356	\$88,989		\$6,457	1,831,813
Fuel and Explosives Branch:		\$1,006					3,034,664
Coal Division.....							
Explosives Division.....			92,216	533,892			1,856,855
Petroleum and Natural Gas Division.....		36,206		5,088			137,369
Synthetic Liquid Fuels Division.....				25,857			2,694,836
Total.....		36,206	92,246	564,807			3,918,010
Economics and Statistics Branch:							
Coal Economics Division.....							8,637,070
Foreign Minerals Division.....			560,612				722,153
Metall Economics Division.....				57,405	\$12,911		90,979
Accident Analysis Division.....			15,521				315,378
Nonmetal Economics Division.....							92,469
Petroleum Economics Division.....							69,891
Total.....			576,133	57,405	12,941		52,396
Health and Safety Branch:							
Coal Mine Inspection Division.....							1,343,566
Safety Division.....							
Health Division.....				10,515			425,469
Explosives Control Division.....							491,881
Total.....				10,515			119,754
Total appropriations.....	\$37,381	494,866	703,000	1,307,030	13,000	6,500	25,301,457
Total expenditures.....		37,212	702,259	731,716	12,941	6,457	17,250,648
Balances.....	137,381	148,654	741	1575,314	59	43	8,050,809

1 Available for expenditure in fiscal year 1947.

Geological Survey

W. E. WRATHER, *Director*



Geologic Branch

THE fiscal year 1946 was in many ways a year of transition, and the activities of the Geological Survey were of necessity divided. A large proportion of the work of the Geologic Branch consisted of the preparation of reports on the varied and valuable projects carried on during the war. As the year progressed, however, an increasing amount of attention was given to the Survey's normal function of long-range geologic research.

Metals and Nonmetallic Minerals

In the study of metals, 45 major projects were carried on, of which 14 were completed during the year. About two-thirds of these investigations were of deposits of the base metals—copper, lead, zinc, and iron—with particular attention paid to lead and zinc. Because of the great depletion of our reserves of the base metals during the war, plans for the future call for continued extensive exploration. The major projects were carried out in 18 States, in 7 of which part or all of the work was done in cooperation with State agencies. Three major projects were carried out in the Missouri River Basin as a part of the development program of the Department of the Interior. In all, 16 geologic reports accompanied by maps, were published, and 30 other reports were placed in open files for public inspection.

In the field of nonmetallic minerals, fluorspar investigations were continued in seven States, many of them in cooperation with State organizations and the Bureau of Mines, and four bulletins were published. Field investigations of pegmatite deposits containing mica, lithium minerals, tantalum, beryllium, and feldspar were curtailed, but reports on the deposits of six States have been completed, and reports on other States are nearing completion. Deposits of high-alumina clay were studied in a number of States, and reports on the investigations are being prepared. Field surveys designed to aid the search for new deposits of talc and potash were continued, and maps showing the location of nonmetallic mineral resources and construction materials in the Missouri River Basin were prepared and published.

Fuels

Continuing its program of regional geologic studies to aid the intensified search for new supplies of oil and gas, the Geological Survey conducted investigations in 20 States. The work was directed primarily to the accumulation and interpretation of fundamental geologic data necessary to delineate new areas in which the geologic structure is favorable for the occurrence of oil and gas. In conducting this program the Geological Survey has received the active collaboration of the oil and gas industry, State geological surveys, and other geologic organizations whose work contributes to but does not duplicate that being undertaken by the Federal survey. Most of the results of the current work are embodied in a series of preliminary maps and charts, on which are printed brief explanatory texts. These are usually published within a few months after the manuscript reports of the field parties are received in Washington. During the fiscal year, 34 such reports were printed by the Geological Survey, and more than 23,000 copies were distributed.

To appraise the potentialities and reserves of substitutes for liquid petroleum the Geological Survey, in cooperation with the Navy Department and the Bureau of Mines, completed during 1946 a study of the oil-shale deposits in naval oil shale reserves Nos. 1 and 3 in western Colorado. The results of this work showed much larger resources of shale oil than had been anticipated originally and served to emphasize the need for additional work of a similar nature in large, essentially unsurveyed areas of oil shale in the Rocky Mountains and other regions. The low-rank coals, which, like the oil shales, occur most abundantly in the Rocky Mountain region, are also a potential source of petroleum substitutes and should be the immediate subject of investigation in order to obtain adequate information concerning the distribution and available reserves. The quantity, quality, and distribution of these two sources of petroleum substitutes are major factors in the development of techniques for their utilization.

The search for new supplies of coking and special-purpose coals was continued during the year, largely in cooperation with the Bureau of Mines, in Colorado, Washington, Alabama, Georgia, and Maryland.

Areal Geology

Extensive and systematic geologic surveys planned for the postwar years were begun during 1946. These surveys are to provide geologic maps containing basic data needed by soil scientists and engineers, as well as in the search for hidden deposits of minerals. Work on these maps is being done in cooperation with State agencies and with such Federal agencies as the Bureau of Reclamation and the Bureau of Plant Industry, Soils, and Agricultural Engineering, Department of Agriculture. During 1946, 13 quadrangle maps covering approximately 1,650 square miles in the States of Massachusetts, Montana, North Dakota, Rhode Island, and Wyoming

were completed. Mapping was under way in 28 additional quadrangles in these States and in New Mexico and Texas. Work on a small-scale geologic map of the State of South Dakota was completed, and work on a similar map of Montana continued.

During 1947 the program of large-scale geologic mapping will be stepped up and will include several of our national parks and monuments, where the availability of increased geologic information will add materially to public appreciation of the scenic beauties and varied natural resources.

Special projects carried out in 1946 included a study of shore-line changes in Massachusetts, where much property was damaged during the great storms of 1944-45, and a study of the occurrence of selenium in bedrock in South Dakota to delineate belts wherein plants concentrate amounts of selenium that are poisonous to grazing stock.

Engineering Geology

Engineering geologists within the geologic branch are devoting their efforts to the collection, interpretation, and dissemination of geologic data for the use of engineers. This group has its headquarters in Denver, Colo., where they work in close cooperation with the engineers of the Bureau of Reclamation. During 1946 they prepared preliminary maps showing deposits of sand and gravel and other construction materials in six States and made detailed engineering geologic studies of four quadrangles in North Dakota. Other projects that were begun during the year and will be continued in 1947 include studies of reservoir sites, landslides, mine waters, and various kinds of subsurface data of interest to construction engineers. In cooperation with the Public Roads Administration, special engineering soil maps of certain areas are being prepared, and systematic studies of the physical properties of rocks have been started.

Basic Research

Specialized groups of scientists in the Geological survey spent most of their time during the war in furthering the work of the economic geologists on projects directly concerned with the search for needed war materials. In this group are chemists, physicists, petrologists, and paleontologists. In increasing numbers they are now being returned to their normal pursuits. The chemists and physicists are conducting basic research on analytical methods and determinations of radioactivity, on spectrographic procedures and X-ray techniques. The petrologists are expanding their studies of many minerals, particularly clay minerals and related substances that eventually may become valuable sources of aluminum and zinc. The paleontologists, while continuing to support the work of the economic geologists by furnishing data derived from the study of fossil collections, are resuming general studies of fossil faunas and floras that were interrupted by the war.

During 1946, air-borne magnetometer surveys covering about 70,000 square miles were made by the Geological Survey in cooperation with the Office of Naval Petroleum and Oil Shale Reserves. The surveys were made over potential oil-producing areas in northern Alaska, Wyoming, New Mexico, and the coast of the Gulf of Mexico, and over magnetic iron regions in the Adirondacks. The instrument has been modified and field methods have been improved so that large areas can now be surveyed more rapidly and more accurately than by ground magnetic methods—the air-borne method is 50 to 500 times faster and provides more detailed data.

The air-borne magnetic surveys made during the past two years were largely experimental; most of them covered from a few hundred to a few thousand square miles. Plans for the fiscal year 1947 call for surveys of much larger areas, such as the Lake Superior iron and copper regions and eastern and southwestern mining and fuel-producing regions. These surveys will be made primarily to obtain information on the structure of the rocks and on economic geology.

The evaluation of domestic resources of fissionable materials needed in atomic research has entailed field work in 32 States and has disclosed much new and valuable information. Reconnaissance investigations of State-wide areas have successfully delimited local areas in which detailed study was warranted, and research on the geophysical and geochemical properties of these materials, conducted both in the field and in the laboratory, has resulted in a further refinement of the techniques of exploration and detection. Long-range research on the properties of fissionable materials has been started to obtain further data. This program has definite postwar value because the new uses for fissionable materials, either actual or potential, make it imperative that we adequately appraise our domestic resources.

Military Geology

The Military Geology unit in 1946 prepared 12 comprehensive intelligence reports for the Corps of Engineers. These reports concerned terrain, water supply, construction materials, mineral resources, and correlation of mines detector performance with soil and rock characteristics. A special terrain intelligence folio on the Fort Knox Reservation, Ky., was prepared at the request of the Armored Forces and will be used for training purposes. A manual of military geology, requested by the Engineer Board, Fort Belvoir, for use in officer training, was virtually completed at the end of the fiscal year.

Beginning in October 1945 a large group of geologists was assigned to Natural Resources Section, General Headquarters, Supreme Command Allied Powers, in Tokyo, forming the main part of the Mining and Geology Division. They made studies of Japan's mineral resources, metallurgical plants and processes, coal, construction materials, and water resources.

Many short reports were prepared, and by the end of the fiscal year 25 special reports were virtually completed. Similar work was done in Korea.

Field work was begun on a geologic map of Okinawa. This work is expected to be completed in the coming year, when similar studies will be undertaken in Palau, Guam, Yap, and Saipan.

Detailed geologic studies of Bikini Atoll were made prior to the atomic bomb tests. These surveys will be repeated after the bombing to determine the effects of the explosions on the islands, the reefs, and the floor of the lagoon.

Two geologists assigned to the general engineer district, Manila, are engaged in making surveys of construction materials to aid in the rebuilding of Manila. They are also cooperating with the Philippine Bureau of Mines in a program designed to develop the valuable mineral deposits of the islands.

Work in Other American Republics

In Mexico, Cuba, Brazil, and Peru, 14 mineral commodities were studied cooperatively under the auspices of the State Department. Geologic investigations were carried on in the vicinity of Mexico's new volcano, Parícutin; a geologic map of the area was completed, and a new topographic map, based on recent air photographs, is being compiled.

In Chile a reconnaissance of the mineral deposits of the Southern Archipelago was begun, and ground-water studies were undertaken in the central and northern parts of the country. These investigations, which were requested and financed by the Chilean Government, will be continued into 1947.

Some of the tin deposits of Bolivia and the manganese deposits of Cuba were investigated with funds furnished by the Foreign Economic Administration.

Four training grants were awarded to Latin-American students of geology. Two of these were given to Mexicans and two to Peruvians, the funds being supplied by the State Department.

Alaskan Branch

The work of the United States Geological Survey in Alaska is directed primarily toward aiding in the development of the mineral resources of the Territory. This has involved field investigations in the course of which the known productive camps have been examined and about 300,000 square miles, or approximately half of Alaska, has been mapped topographically and geologically on reconnaissance standards. Many of the activities carried on during the war years and continuing through the 1946 field season have been relatively detailed examinations of specific areas or deposits, the results of which have been made available to appropriate war agencies, largely in the form of preliminary reports and maps. The distribution of

many of these publications is still restricted because of War Department regulations, but they are being released to the public as rapidly as possible.

The war years have seen a greatly increased public interest in Alaska, which is already beginning to express itself in long-awaited postwar ventures on the part of both private interests and Territorial management. The objectives of the Alaskan Branch in its expanded postwar program reflect this interest. The investigations by the technical personnel engaged in field studies during the field seasons, which are short because of the unusual climatic conditions, has resulted in the issuance of a series of reports covering detailed examinations of a large number of mineral deposits, some whose worth was previously undetermined, others whose very existence was uncertain. Though few of these deposits have as yet reached the stage of commercial development, many stand available as sources of added raw materials to replenish the stock piles that dwindled during the war. As a result of these relatively limited studies the known reserves of many of the economically important minerals in Alaska have been substantially increased. For example, quicksilver, formerly considered a resource of only minor significance, has become one of the important commodities now commercially produced in Alaska. The explorations by Alaskan Branch geologists have revealed additional coal reserves estimated at millions of tons.

Past Mineral Production

The importance of mineral resources as a factor in the development of Alaska is indicated by the prewar cumulative production of minerals worth more than \$800,000,000. This is further emphasized by the fact that in the last prewar year (1940) the value of the mineral production was the greatest in the history of the Territory.

The mining of gold has been Alaska's major industry. Gold produced prior to 1940 amounted to more than \$600,000,000. The year of lowest mineral production was 1927. Since that time, owing in part to the increase in price of gold from \$20.67 per ounce to \$35 per ounce and in part to improved mining methods, the quantity of gold produced has increased more than 260 percent and its dollar value has increased more than 430 percent. Although seriously curtailed during the war, gold mining has shown a strong recovery since the cessation of hostilities.

As byproducts of the production of gold, silver worth more than \$14,000,000 and lead worth nearly \$3,000,000 have been produced. The increase in the amount of silver has been in proportion to the total quantity of gold produced, because all crude gold contains a few percent of silver. The amount of lead has varied in proportion to the amount of gold taken from lode mines, because lead is a byproduct of lode-gold mining.

In contrast to the wartime slump in the production of gold and associated metals, the demand for coal has greatly increased. The value of coal mined prior to 1940, about \$14,000,000, in no way represents the potential capacity of Alaska to produce coal. Field work during the war years has dis-

closed reserves which, if developed, would be ample to provide for any predictable increase in demand, and other areas known to be coal-bearing have not yet been investigated.

Future Development

Alaska's mineral resources have been so slightly tapped, despite the forced production of certain commodities during the war, that any calculation in terms of dollars and tonnage reserves can be at best only a rough approximation, but the known value of Alaska's mineral resources can be set at a minimum of several billions of dollars.

The efforts of the Alaskan Branch, never numbering more than the 53 geologists at its present peak and through most of the half century of its life only between 5 and 10, have been widely spread over most of Alaska's nearly 600,000 square miles of country and have resulted in the accumulation of a considerable body of sound and lasting information; but the task ahead is tremendous.

The accelerated program carried on during the war was coordinated with anticipated future development of the Territory. The war has stimulated Alaska. Many of the thousands of servicemen who passed through or were stationed in Alaska have become greatly attracted to the Territory; never again will there be the lack of interest that formerly existed. With the growing interest in Alaska are coming increased inquiries as to the possibilities there for newcomers. An important part of the work of the Alaskan Branch will be the meeting of the demands for information from servicemen, private citizens, and corporations. As a result of its war activities the Branch is better able than at any time in the past to reply adequately to such questions; but far more work is needed to keep pace with the growing demands.

The future settler in Alaska can be helped immeasurably in planning his new life, and the development of the Territory on a sound basis can be expedited if the Alaskan Branch and other Government agencies, each in its respective field, are able to supply the needed answers. Alaska's development must be based on a sound and enduring economic structure which has been established with an understanding of the aims and methods of true conservation, not only for the safeguarding of resources but also to insure the success of prospective citizens in their varied ventures.

One of the prime requisites for the establishment and maintenance of a highly developed civilization is the production and regular revision of a series of large-scale topographic maps of high detail and accuracy. The most efficient development of any area is impossible without careful study of such maps. The most desirable locations for townsites, highways, reservoirs, airports, and a myriad of other works of man require, at least initially, a careful examination of detailed topographic maps. As a result of its work for the Army Air Forces, small-scale aeronautical pilotage charts have been completed by the Branch for the greater part of the Territory; but

these, while they will serve as a springboard for future mapping activity, are inadequate to meet the demands of a developing civilization. Less than 1 percent of Alaska has been mapped in the detail and accuracy considered essential in the United States for areas of only moderate development.

With the production of adequate detailed maps should come a greater intensification of diversified geologic examinations. Before the war the emphasis was placed on investigations contributory to the production of gold; during the war it was placed on the development of minerals essential to the war program; since the end of the war the emphasis logically has shifted to a program of diversified mineral production. The development of deposits of nonmetallic mineral commodities, such as limestone, gypsum, marble and other building stones, clay, gravel, and sand, may make important contributions to the establishment of a sound and stable society in Alaska. Alaska's fuel resources, her coal and perhaps petroleum, when adequately developed, may prove sufficient not only for her own needs but to sustain a considerable export trade as well. Many such materials or their finished products are now being shipped to Alaska, though her own reserves, as yet practically untouched, might be able to offer the same or better materials with lower costs and greater efficiency. Along with the postwar development of such mineral resources the Alaskan Branch must continue at an increased tempo the delimitation of areas in which the production of metallic minerals is or may become possible. It is the Branch's duty to provide the basic information necessary for the continuation, expansion, and greater diversification of Alaska's mineral industry.

Field Season of 1945

During the 1945 field season, which included the latter part of the fiscal year 1945 and the earlier part of the fiscal year 1946, the work of the Alaskan Branch was directed exclusively to projects designed to make the maximum contribution to the Nation's war effort. The need was recognized for keeping the activities as flexible as possible to meet changing war conditions. Many of the more general and broader studies that had been carried on over a period of years and would require additional work for their completion were temporarily laid aside so that the efforts of the technical personnel of the Branch could be focused closely on the investigation of areas or deposits that seemed most likely to become producers of strategic and critical minerals needed in carrying on the war and on related activities of direct war pertinency. Conclusions and results were sought that would be specific and of definite value to those Government agencies and private individuals immediately concerned with the development of such reserves. Particular attention was given to petroleum, coal, and quicksilver. The working season of each field party was planned to extend to the maximum feasible under the climatic conditions prevailing in that

area. This policy continued to the end of the season despite the conclusion of the war in August.

Field Season of 1946

The end of the war early in the fiscal year 1946 brought a change in the emphasis placed on war-sponsored projects. Plans being carried out in 1946 show a marked revival of the normal pre-war program of geologic mapping in Alaska. The partial reversion to peace-time activities is reflected also by the resumption of the long-range investigations in areas considered to be potentially valuable as mineral producers.

Certain of the programs which were supported by the Army or the Navy during the war years as urgent war-time measures have proved to be of general scientific interest as well. The Alaskan Branch geologists assigned to some of these projects, such as permafrost and volcano investigations in the Aleutian Arc, developed techniques and accumulated knowledge too valuable to be shelved as the war ended. The Alaskan Branch has allotted funds for continuation of both of these projects.

In the fiscal year 1946 and during the 1946 field season the Alaskan Branch has carried on eight programs of special investigation, each under the direction of a supervisor. The eight groups are metals, nonmetals, northern Alaska oil, southern Alaska oil, coal, permafrost, volcano studies, and Alaska mapping. Of special interest is the Aleutian volcano program which, during the fiscal year 1946, was supported wholly by funds transferred to the Geological Survey by the War Department. Field work during the present field season is being conducted on Mount Pavlof, on Umnak Island, and on Great Sitkin Island, as well as reconnaissance surveys directed toward the planning of future projects. A major purpose of the program is to analyze volcanic phenomena so that it may be possible eventually to predict destructive activity and by advance warning reduce the danger to Army installations and personnel. It is hoped that the progress made so far will warrant continued support by the War Department in the fiscal year 1947.

Mapping Activities

The major mapping activity of the Alaskan Branch during the 1945 field season was a continuation of the Army Air Forces program, in which aeronautical pilotage maps and charts of areas throughout the world were compiled from photographs furnished by the Army Air Forces.

The prewar program of topographic mapping in Alaska has been partially resumed. Topographic maps prepared by the Alaskan Branch of the Geological Survey are utilized by governmental agencies, commercial firms, and private individuals for a great variety of purposes, such as the following: Tracing waterways for transportation and water supplies; locating trails, highways, railroads, pipelines, and lines of communication; study of terrain

for the location of bridges, dam sites, power plants, and other industrial plants; estimating the possible water supply for placer mining and other industrial operations; classification of public lands and mapping of agricultural land, national forests, Indian reservations, mineral lands; plotting the aerial extent of rock formations and working out geologic structure.

A recent order by the Director of the Geological Survey, effective July 1, 1946, provides for the transfer of the topographic mapping facilities and commitments previously vested in the Alaskan Branch, together with such funds as have been allotted or transferred for the purpose, to the Topographic Branch of the Geological Survey. Thus, beginning in the fiscal year 1947 the responsibilities for the various phases of topographic mapping in Alaska will be the concern of the Topographic Branch. It is contemplated that other technical activities of the Alaskan Branch will shortly be transferred to the appropriate functional branches and that proper coordination and integration of all Alaskan activities will be attained through a proposed staff Alaskan geologist, who will be a part of the Director's office. This reorganization within the Geological Survey has been decided upon after long study of the many problems arising out of the great increases in Alaskan activities and Geological Survey responsibilities. It is designed to attain the most efficient use of highly specialized technical personnel and thus effect a more comprehensive and well-balanced pursuit of the studies that contribute so largely toward shaping the social and economic future of the Territory.

Topographic Branch

Topographic maps are fundamentally essential to a survey of the country's resources and are highly valuable for the economical and efficient planning of drainage, flood control, irrigation, water supply, hydro-electric, and transportation projects; they minimize the number of expensive field surveys needed in connection with the location of transmission lines, railways, highways, canals, tunnels, airports, and industrial plants and thereby reduce the cost of construction; they provide topographic data essential to the proper location of frequency-modulated and television radio stations; and they are essential for recording and correlating data obtained from geologic investigations, thus aiding immeasurably in the location, evaluation, and development of our mineral wealth. Maps of this kind provide information necessary for the proper classification and best utilization of the public lands, the conservation of the soil, and the administration and protection of the forests, both State and National.

Topographic mapping in the United States has proceeded at such a slow pace that only a relatively small part of the country may be considered sufficiently well mapped to meet present-day requirements. Half of the nation is without topographic maps; of the maps available to the other half, some are considered adequate for present-day requirements, but others are of too

low quality to meet the varied needs. In the vast domain of public lands, enormous areas have never been mapped; consequently the administrative officials responsible for enforcement of the public land laws are without detailed knowledge of their extent, the character of the terrain, their intrinsic value, or the possibility of their development.

Recognizing the urgent need for topographic maps, the Geological Survey is preparing a report reviewing the status of mapping. A program of sufficient scope to provide adequate maps for the entire Nation within a period of 20 years is being submitted, with recommendations for the enactment of legislation that will make this program effective. The entire 20-year program has been evaluated in its relation to the needs of all Government agencies in order to avoid duplication of effort, to assure uniformity in mapping, to utilize the most efficient modern methods, and to provide the essential maps when and where needed.

Attention is invited to the small summary index map which faces this page. Although about 48 percent of the country is topographically mapped in some manner, much of the older work was accomplished by rapid reconnaissance methods. Less than a quarter of the country is covered by maps considered adequate for present-day requirements and, as the index shows, a considerable number of these maps should be revised for culture or other details to afford satisfactory coverage for modern use.

General Office Work

With the termination of hostilities and return to domestic mapping, the greatly expanded mapping program, as well as improved mapping technique, necessitated reassignment of certain functions within the Topographic Branch. The large amount of work involved in planning and supervising necessitated creation of a staff of engineers to assist the Chief Topographic Engineer to carry out this program.

As part of the plan for reorganization of the Geological Survey, all activities of the Alaskan Branch pertaining to topographic mapping and the making of aeronautical charts for the Air Forces were transferred to the Topographical Branch, effective July 1, 1946. That portion of the work pertaining to topographic mapping in Alaska is to be placed in the Rocky Mountain Division. As part of the same plan the drafting unit of the Section of Inspection and Editing and the functions of the Section of Photomapping, with the exception of the Research and Development Unit, were transferred at the same time to the Atlantic Division.

During the fiscal year 1946 headquarters offices were maintained for the Topographic Branch and Atlantic Division in Washington, D. C.; the Central Division in Rolla, Mo.; and the Pacific Division in Sacramento, Calif. The Rocky Mountain Division was reactivated with headquarters in Denver, Colo. Section offices were maintained in Chattanooga, Tenn., and Arlington, Va.

The major part of the first quarter of the year's activities of the Topographic Branch was directed toward producing maps in manuscript form from aerial photographs made for the War Department. Approximately 80 percent of the time and services of the personnel of the Arlington and Chattanooga groups was devoted to the mapping or supervision of mapping of areas in foreign countries for use of the Armed Forces during that period.

Section of Computing.—The results of geodetic control surveys, which constitute the framework for detailed mapping, are computed, tabulated, and reproduced by the Section of Computing. Lists of reference marks, showing elevations and geographic positions, are furnished to topographers and geologists of the Geological Survey and to surveying units in other governmental organizations. Such data are available also, for limited areas, to civil engineers, surveyors, and geophysical prospectors throughout the United States. During the year, lists of reference marks for 452 quadrangle map areas were issued in lithographed form, and others were prepared as typewritten manuscripts.

Continuous research for new and improved methods for control surveys and computing is another function of this section. During the year a method for determining elevations by precise altimeters was tested and adapted to mapping requirements. Many forms and special tables have been devised so that routine geodetic computations may be done by faster machine methods. Performance data from many sources are continuously assembled and classified for use in preparing practical instruction manuals for control survey work.

Section of Cartography.—Work on the International Map of the World on a scale of 1: 1,000,000 was continued by the Section of Cartography. Seven sheets were in progress—Austin (H-14), Mississippi Delta (H-15), Los Angeles (I-11), Savannah (I-17), Mt. Shasta (K-10), Lake Erie (K-17), and Cascade Range (L-10). At the end of the year two sheets were in course of publication—Hatteras (I-18) and Chicago (K-16).

Preparation of the transportation map for the Public Roads Administration was continued. Compiling, inking, lettering, and editing was in progress for the States of Louisiana, Nevada, Ohio, West Virginia, Alabama, and Indiana. Eight sheets in Virginia and the sheet for Washington and vicinity were transmitted for publication; 10 of the 33 sheets in Texas were published.

A complete revision of State base maps on a scale of 1: 500,000 was started during the fiscal year. Compiling, inking, and lettering is in progress on maps for the States of Wyoming, New Jersey, Massachusetts, Rhode Island, Connecticut, and Delaware.

The Columbia River Basin map was completed and printed.

Section of Inspection and Editing.—During the year 166 quadrangle maps were edited for publication, of which 137 were for multicolor photolithography and 29 for engraving; 150 quadrangle maps, 19 State maps, and 14 State index maps were prepared and edited for reprint editions; 100 maps

and diagrams that had been prepared as illustrations for geologic reports were edited; and 345 proofs of all kinds were read. On June 30 maps in the process of reproduction included 54 for engraving and 72 for multi-color photolithography; maps being edited or awaiting editing included 29 maps for engraving and 17 for multicolor photolithography; and 256 maps remained on hand for preparation for reprinting.

Section of Photomapping.—The principal work of the Section of Photomapping is the production of topographic maps from aerial photographs by stereophotogrammetric methods and the production of planimetric maps and planimetric bases for topographic field surveys by both stereophotogrammetric and graphic methods.

Topographic maps of areas in the United States produced during the year by these methods covered approximately 9,396 square miles; planimetric and base maps covered an area of approximately 10,630 square miles. Topographic maps of foreign areas for the War Department, produced in manuscript form from aerial photographs, covered an area of approximately 9,522 square miles. In addition, Geological Survey personnel, working in cooperation with the Tennessee Valley Authority, either completed or supervised additional foreign mapping for the War Department in the amount of 2,482 square miles.

At the principal office of the section, in Arlington, Va., in addition to large production facilities, which are operating on a two-shift basis, here are also maintained a central laboratory for designing, testing, repairing, and adjusting all types of special optical and mechanical equipment utilized for stereophotogrammetric work and a photographic laboratory specializing on research and precision photography required for the other offices.

The Washington office maintains a general file of aerial photographs utilized in the work of the Geological Survey and of aerial photographic negatives that have been purchased under photographic contracts. Through this office contacts are maintained with other governmental agencies involved in aerial photographic work.

Map Information Office

During the fiscal year a great expansion of the activities and facilities of the Map Information Office was begun. This Office was established in 1919 under the Federal Board of Surveys and Maps with personnel and facilities of the Geological Survey. The Board was abolished in 1942 and its functions assigned to the Bureau of the Budget, at whose request the Map Information Office has since been maintained by the Geological Survey. During the war years this office was relatively dormant because of necessary restriction upon the dissemination of map information and other terrain data. Since the close of the war a greatly increasing volume of requests for map information has been evident, not only from our own map producing units but from other agencies and from the general public. It has therefore become necessary to completely reorganize our previous facil-

ities for the dissemination of map information and considerably broaden the scope of service heretofore available. Several specialized units have been developed within the new Map Information Office for this purpose, namely, Topographic Maps, Aerial Photography, Map Control, General and Foreign Maps, and a service facility for the preparation of reports, exhibits, and index and progress maps.

During the 6 months that the Map Information Office has been functioning with additional personnel the number of visitors and the volume of inquiries, both by letter and telephone, have greatly increased, thus reflecting the attitude of the public to the advantages of such a service.

Topographic Maps.—The Topographic Map Unit is responsible for the research, assembly, evaluation, and maintenance for reference of all topographic data pertaining to the United States and its possessions. Various indexes showing the status of topographic mapping are maintained, for example, the map accompanying this report, which shows the areas of the United States covered by the topographic maps of the Geological Survey that are now considered adequate for general requirements.

Aerial Photography.—Records of the aerial photographic coverage available from all sources are maintained by the Aerial Photography Unit, and facilities are to be developed for film storage and the preparation of prints of Geological Survey photographs, to meet the increasing requests from other agencies and the general public.

Map Control.—The Map Control Unit is responsible for the assembly of data on all surveys considered usable for the control of map compilation by various processes. The maintenance of adequate descriptive data regarding control established by the Geological Survey and distribution of the data to other agencies and the general public is a function now being transferred to this unit, which will also prepare and publish State index maps showing the location of all control lines.

General and Foreign Maps.—The Unit for General and Foreign Maps conducts research for all general maps (other than topographic) of the United States and its possessions for the use of production units in planning and carrying out new mapping projects and for reference in meeting information requests of other agencies and the general public. Regarding foreign maps, only summary data are maintained—sufficient, however, to service general requests for information and the occasional foreign projects undertaken by the Geological Survey.

Exhibits and Special Reports.—During the fiscal year several exhibits were prepared at the request of the Library of Congress, technical societies, and scientific expositions. Permanent exhibits will be prepared during the coming year to meet increasing requests of this nature with a minimum of special preparatory work. Many requests by the press and technical publications for geographic information and for statements regarding the Survey's mapping activities were furnished, and demands of this nature are continuing to increase.

Field Surveys

Topographic mapping was carried on in 35 States. Cooperative projects were conducted with 17 States and with the Tennessee Valley Authority.

TABLE 1.—*Topographic mapping by the Geological Survey in the United States, Puerto Rico, and Hawaii, to June 30, 1946*

State	Area mapped during fiscal year 1946 for publication on standard scales, contour intervals from 1 to 50 feet (square miles)				Total area mapped to June 30, 1946 (square miles)	Percent- age of total area of State mapped to June 30, 1946	Control, fiscal year 1946		
	Field scale		New survey	Resur- vey			Spirit levels (miles)	Transit traverse (miles)	Triangu- lation stations estab- lished
	1 to 24,000 or larger	1 to 48,000							
Alabama	539		270	269	26,348	51.1	317	382	
Arizona	138	1,415	1,415	138	34,936	30.7	365		54
Arkansas		37	37		24,667	46.5		8	
California		425	187	238	132,817	83.7	580		100
Colorado	1,226		98	128	58,363	56.0	83	45	41
Connecticut					5,009	100.0			
Delaware					2,057	100.0			
District of Columbia					69	100.0			
Florida					11,949	20.4			
Georgia	106	79		185	25,202	42.8	378	295	
Idaho	194	142	335	1	37,964	45.4	88		17
Illinois	12	1,915	1,927		47,764	84.7	326	343	
Indiana	565		565		8,749	24.1	574	355	
Iowa					14,233	25.3			
Kansas	10	377		387	65,852	80.0		169	
Kentucky	296		246	50	27,805	68.8		31	
Louisiana	337	8	316	29	18,901	39.0	252	187	
Maine		436		436	25,977	78.2			
Massachusetts					10,577	100.0	235	228	18
Michigan					8,257	100.0			
Minnesota					17,802	30.6	224	94	
Mississippi					9,572	11.4	80	85	
Missouri					9,010	18.9			
Montana					63,948	91.8	15	160	
Nebraska					39,788	27.0	193	80	10
Nevada					28,408	36.3	1,053	456	31
New Hampshire		184	184		44,165	40.0	50		20
New Jersey		70		70	9,304	100.0			
New Mexico					7,836	100.0			
New York					36,676	30.1	498	77	64
North Carolina	561	68		629	49,576	100.0			
North Dakota	45	46	91		19,665	37.3	402	176	
Ohio	68	744	812		18,147	25.7	1,268	1,171	
Oklahoma					41,222	100.0		160	
Oregon	2		2		41,901	59.9	518	334	16
Pennsylvania		319	319		36,438	37.6	71		17
Rhode Island	398		398		43,961	97.0		35	14
South Carolina					1,214	100.0			
South Dakota	368	261	629		16,401	52.8	19	63	
Tennessee					20,750	26.9	519	464	30
Texas	470			470	23,998	56.8			
Utah		659	659		93,395	34.9	814	406	38
Vermont		44	44		20,272	23.9			
Virginia	6	124		130	9,365	97.5			
Washington	91	590		681	38,097	93.3		54	
West Virginia		158	158		44,561	65.3	212		36
Wisconsin		(2)			24,181	100.0			
Wyoming	42	309	351		20,348	36.2	166	109	
					36,169	36.9	100		
Total	5,646	10,829	11,206	5,269	1,453,666	48.1	9,400	5,967	506
Hawaii					6,435	100.0			
Puerto Rico					3,370	98.8			

¹ Includes 182 square miles mapped on scale of 1:31,680.

² Planimetric maps covering 1,117 square miles in Wisconsin, not included in total surveys, were compiled from aerial photographs with field examination.

The mapping of 56 15-minute quadrangles and 105 7½-minute quadrangles was completed, and mapping was in progress on 68 15-minute quadrangles and 109 7½-minute quadrangles at the end of the year. In addition, work on 336 quadrangles was progressing in some one of the steps prior to actual mapping.

For the Corps of Engineers, Army, the mapping of parts of four rivers was completed and mapping was in progress on three additional projects for flood control in several States. The mapping of Fort Knox, Ky., was completed for the War Department, and basic control accomplished at Fort Benning, Ga., Fort Bragg, N. C., Wright Field, Ohio, and Fort Ord, Calif.

At the request of the Bureau of Reclamation, mapping on a large scale was completed for the Canton project, Oklahoma, and the Englewood project, Oklahoma-Kansas; basic control was accomplished on the Mora River and Chico Creek projects, New Mexico, and an extensive survey begun in the Missouri River Valley for the study of water power, flood control, and irrigation in many States.

At the request of the National Park Service, large-scale mapping was completed of the home of Franklin D. Roosevelt National Historic Site and the Vanderbilt Mansion National Historic Site, Hyde Park, N. Y.

Culture revision of the Yosemite National Park in California was completed. The survey of Olympic National Park in the State of Washington was continued. For the development of a recreational area in Indiana, a survey was made of the Mississinewa River from the city of Marion to the Wabash River.

For use in the development of the Columbia River Basin, for power, flood control, and irrigation in many States, mapping was in progress on the Snake River in Idaho.

At the request of the Geologic Branch, a large-scale map of Gabbs and vicinity, Nev., was made for the study of magnesite deposits, and radar stations were established to control an airborne magnetometer survey in the Gulf of Mexico. The revision of all topographic maps in the San Joaquin Valley, Calif., was begun. A large-scale map of the Naval Oil Shale Reserve, Colo., was completed for the Navy Department.

Water Resources Branch

The need for information on our water resources is evidenced by the steadily increasing number of requests from Federal, State, county, and municipal authorities in all parts of the country for investigations of the availability and chemical quality of water. This information is essential to successful planning and construction of projects related to many purposes, including irrigation, inland navigation, power production, industrial installations, municipal supplies, and flood control, which involve the storage, control, or use of water, and therefore require continuous and up-to-date

records concerning its fluctuations in quantity and quality, and its availability and utility. The needs arise from greatly increased use of water; from shifting of population as a result of establishment of new industries in areas that were previously rural or thinly settled; from the expansion of existing industries; and from our needs for increased production of power and agricultural products. Programs of water investigations are accordingly being expanded in all sections of the country.

Normal growth in the use of water has been accelerated and the need for information concerning it intensified by new basin-development projects, patterned in concept but apparently not in organization somewhat after the Tennessee Valley Authority. The Missouri River Basin is now being developed for flood control, irrigation, navigation, and water power. Similar development programs for other basins, such as those of the Arkansas and Columbia Rivers, are expected to follow. Such projects rest primarily on the availability and use of water. They require, therefore, much more comprehensive investigations of the water resources of those basins than have heretofore been considered urgent.

Major development and reconversion projects involve the use of water in large quantities. Reliable information concerning the available supply must be available before such projects can be safely planned and satisfactorily executed. Water investigations by the Geological Survey precede and must be closely coordinated with the programs and projects of constructing and operating agencies. Realization of the need for coordination is demonstrated not only in connection with the trend toward basin development but also by the cooperative grants made by States and municipalities, which in 1946 aggregated more than \$1,600,000, and by other Federal agencies, which provided to the Survey more than \$1,300,000 for special water investigations made at their request.

The operation of hydraulic and industrial plants requires current information as to fluctuations in water supplies. As the limit of supply is approached or reached, the demand for reliable information increases and becomes more insistent. Although funds for financing the needed investigations have been increased in recent years they are yet inadequate to meet pressing needs.

Water investigations must be made locally because of the wide variations in quantity from place to place and because of the great fluctuations at any one place resulting from the vagaries of precipitation. The Survey's investigations of water have always been made chiefly from field offices, and the decentralization has become even more marked in recent years: in 1946 the work was conducted from more than 100 field offices, with one or more such offices in every State and in the Territory of Hawaii. This decentralization has resulted in a high degree of efficiency and economy of work and in better service to the public. Through the field offices close contacts are maintained with local Federal, State, and municipal officials, and the interests of cooperating agencies are served. The Survey's field offices are local

sources of information as to available water resources, fluctuations in the ground water table, and fluctuating stage and discharge of surface streams.

Funds aggregating more than \$5,000,000 were available for water investigations in the fiscal year 1946. Of that amount about 41 percent was appropriated by Congress, about 33 percent was contributed by States and municipalities, and about 26 percent was provided by other Federal agencies.

Cooperation With States and Municipalities

States and municipalities provided about a third of the funds for the Survey's water investigations during the fiscal year 1946. The amounts contributed for cooperation in each State are summarized below:

State	Total offered	State	Total offered
Alabama.....	\$18,315	New Hampshire.....	\$10,114
Arizona.....	67,899	New Jersey.....	24,950
Arkansas.....	23,500	New Mexico.....	51,845
California.....	98,149	New York.....	117,119
Colorado.....	42,500	North Carolina.....	29,094
Connecticut.....	11,550	North Dakota.....	29,184
Delaware.....	2,000	Ohio.....	56,691
Florida.....	59,526	Oklahoma.....	26,296
Georgia.....	21,500	Oregon.....	29,802
Idaho.....	29,250	Pennsylvania.....	55,751
Illinois.....	34,092	Rhode Island.....	4,700
Indiana.....	41,212	South Carolina.....	14,633
Iowa.....	32,747	South Dakota.....	8,480
Kansas.....	34,667	Tennessee.....	31,657
Kentucky.....	27,329	Texas.....	93,137
Louisiana.....	31,079	Utah.....	39,167
Maine.....	7,500	Vermont.....	6,260
Maryland.....	30,750	Virginia.....	38,319
Massachusetts.....	17,288	Washington.....	67,981
Michigan.....	43,861	West Virginia.....	14,550
Minnesota.....	19,840	Wisconsin.....	16,039
Mississippi.....	14,981	Wyoming.....	32,009
Missouri.....	20,561	Hawaii.....	58,468
Montana.....	25,231	Puerto Rico.....	2,700
Nebraska.....	34,988		
Nevada.....	26,883		
			1,676,144

Activities Carried on for Other Federal Agencies

Other Federal agencies provided in 1946 more than \$1,300,000 for water resources investigations that could not be financed by appropriated funds of the Geological Survey or included in cooperative programs. These agencies are the Bureau of Reclamation, Office of Land Utilization, Office of Indian Affairs, Fish and Wildlife Service, Southwestern Power Administration, Bonneville Power Administration, and National Park Service, Department of Interior; Office of the Chief of Engineers, War Department; Navy Department; State Department; Soil Conservation Service, Depart-

ment of Agriculture; Weather Bureau, Department of Commerce; Tennessee Valley Authority; Federal Power Commission; Federal Works Agency; Rubber Reserve Corporation; and Foreign Economic Administration.

Operational Activities

The operations of the Water Resources Branch have been conducted by four administrative units—Division of Surface Water, Division of Ground Water, Division of Quality of Water, and Division of Water Utilization.

Surface Water.—Records of stage, quality, and availability of surface waters are collected through 56 field offices at 5,807 gaging stations distributed throughout every State and the Territory of Hawaii, in cooperation with 172 State and municipal agencies and with many Federal agencies.

Ground Water.—The investigations of ground water relate to water from which wells and springs are supplied. They are conducted through 36 field offices, in nearly every State and Hawaii, in cooperation with 72 State and municipal agencies and with several Federal agencies. Periodic measurements of water levels or artesian pressure were made at about 7,000 observation wells.

Quality of Water.—Determinations of quality were made of 2,124 samples of water in the laboratory in Washington, D. C., and of 5,635 samples in laboratories in Albuquerque, N. Mex., Austin, Tex., Fayetteville, Ark., Raleigh, N. C., and Charlottesville, Va. Cooperative studies of the chemical character of surface waters were in progress in Pennsylvania, Virginia, Florida, Georgia, North Carolina, Louisiana, Arkansas, Texas, and New Mexico. Samples were analyzed for cooperative studies of ground water in those and other States.

Utilization of Water.—Water utilization studies were made in the Washington office and 3 field offices, financed in part by other Federal agencies.

The important relations of the chemical quality of water to its utility for many purposes have become increasingly apparent in recent years. The great increase in the industrial pollution of water caused by war activities in many regions widely scattered throughout the country and the lag during the war in the treatment of waters to improve their chemical quality have served to emphasize the importance of quality in connection with programs of development and operation. There has been, therefore, a considerable expansion of the Survey's investigational programs related to quality of water and of the equipment of chemical laboratories for the economical conduct of those programs. Besides the central laboratory in Washington, D. C., the Survey now operates chemical laboratories for the analysis of water in Charlottesville, Va., Raleigh, N. C., Lincoln, Nebr., Fayetteville, Ark., Austin, Tex., and Albuquerque, N. Mex. A laboratory is to be installed at Salt Lake City, Utah, in 1947.

Sediment carried by rivers is deposited in reservoirs, canals, and navigation channels. Determinations of its quantity is important, therefore, in

connection with the planning of projects for the storage and use of water, the design and construction of hydraulic structures, and the operation of hydraulic works. Much more attention than formerly is now paid to the systematic measurement of the sediment content of those rivers that carry considerable quantities of matter in suspension. The Survey has served in an interagency committee on the design of an improved sediment sampler for use by all agencies that measure the sediment content of flowing water, to the end that greater accuracy may be attained and that the results may be reasonably consistent. In 1946, the Survey operated laboratories for analyzing sediment at Albuquerque, N. Mex., Lincoln, Nebr., Worland, Wyo., and Dickinson, N. Dak.

Missouri River Basin.—The coordinated projects of the Bureau of Reclamation and the Office of the Chief of Engineers for the basin-wide development of the Missouri River Basin have led to unusual expansion of water investigations in that basin. The investigational programs, conducted generally in cooperation with States and municipalities, have been supplemented during 1946 by the installation of 96 gaging stations; by expansions of ground-water studies to cover areas in 19 localities where problems related to ground water levels or to changes in those levels resulting from reservoir construction or irrigation may be expected; by measurements of the sediment content of surface waters at 23 stations; by systematic records of the chemical quality of the waters of 4 rivers and by miscellaneous records of 40 other rivers; and by hydrologic and utilization studies related to the proposed plans of development. The information obtained by these investigations is furnished to the action agencies currently or periodically as may be desired.

Interstate and International Agreements

Interstate compacts for equitable division between States of waters of interstate streams, which require the Geological Survey to establish and operate gaging stations, are now in effect on the Colorado River (Wyoming, Utah, Colorado, New Mexico, Arizona, Nevada, California); the Belle Fourche (Wyoming, South Dakota), the Republican River (Nebraska, Kansas), and the Rio Grande (Colorado, New Mexico, Texas). To these are to be added in 1947 similar activities on Costilla Creek (Colorado, New Mexico).

International problems related to water are increasing. The current development activities in the Missouri River Basin, the proposed development in the Columbia River Basin, and the application of the treaty effective November 8, 1945, with Mexico in relation to the division between the United States and Mexico of the waters of the Rio Grande and of the Colorado and Tia Juana Rivers are increasing the problems related to water arising on both the northern and southern boundaries, in which the

State Department is involved and for which that Department transfers money to the Geological Survey for special investigations that are needed.

Reports on Investigations

The results of the varied hydrologic and hydraulic studies and computations made by the Water Resources Branch are made available for public inspection as soon as practicable by placing manuscript copies of observations, measurements, and analyses in the open files of the district offices concerned, as soon as they have been approved.

The published work of the Water Resources Branch during the fiscal year 1946 consisted of 21 Water-Supply Papers; 14 issues of the Water Resources Review, a mimeographed monthly summary of stream flow and ground-water conditions in the United States and Canada; 9 mimeographed reports, 8 reports published by cooperating State agencies, and a large number of short technical papers in professional journals.

Conservation Branch

The Conservation Branch, under delegation of authority from the Director, classifies the public lands of the United States as to mineral and water resources and supervises operations on public, Indian and naval petroleum reserve land leases, permits, and licenses, for the development of these vital natural resources. The work requires the maintenance of a headquarters staff in Washington and a field staff competent to solve problems of geology, engineering, economics, and administration in complying with legislation enacted by the Congress, which contemplates that this Nation's resources shall be developed and produced by private enterprise in accordance with approved methods. The activities include field investigations, the preparation of maps and reports dealing with water power, fuels, minerals, and chemicals essential to the postwar economy of the United States, and "on-site" supervision of mining and drilling operations essential to the production thereof.

Classification of Lands

Mineral Classification.—In continued response to war-engendered demand for additional supplies of mineral fuels, fertilizers, and basic chemicals from the public domain, most phases of the service rendered by the Mineral Classification Division in the administration of public and semipublic lands were maintained at an accelerated pace during 1946.

In all, about 12,000 cases were acted on during the year, a 9 percent decrease from 1945 that is attributable in no sense to diminished demand for classification service but wholly to insufficient personnel. Initial or revised definitions of the known geologic structure of 71 producing oil or

gas fields were prepared and promulgated; geologic appraisal was made of 90 unit-plan or participating-area submissions; some 58 special reports were rendered to the General Land Office on new discoveries of oil or gas on or adjacent to Federal lands, including 22 applications for the royalty benefits of the act approved December 24, 1942 (56 Stat. 1080), for the discovery of new oil and gas fields or deposits during the war emergency; and, for a variety of extradepartmental agencies concerned with the disposal of acquired lands of the United States, determinations were made of the potentialities for fissionable materials of some 970 land parcels in various States, Territories, and possessions, pursuant to Executive Order No. 9701 of March 4, 1946, and to authority for such determinations delegated to the Geological Survey by Department Order 2188 of April 19, 1946.

From field headquarters in Colorado, Wyoming, Montana, Utah, and California, division geologists made numerous "spot" investigations precedent to public-land and mineral-leasing law administration, and as useful byproducts of its field studies, effected the publication of new or revised maps of the areal geology and structure of the Garland-Byron area and Little Buffalo Basin area, Big Horn and Park Counties, Wyo., and the Arden area, Clark County, Nev.

Water and Power Classification.—The Water and Power Division obtains basic information concerning the water-power resources and storage possibilities of Federal lands. During 1946 the work was confined largely to projects proposed for early development. Work in the Missouri River Valley was greatly expanded to meet the need of the Bureau of Reclamation and the Corps of Engineers, United States Army, for maps to use in planning future projects in that valley.

Topographic surveys were made of 3 dam sites and 137 linear miles of stream valley, of which 64 miles is in the Missouri River Basin. In cooperation with the Water Resources Branch, supervision of construction and operation was given to 163 power projects under license from the Federal Power Commission, to 230 such projects under permit or grant from the Department of the Interior, and to 161 in cooperation with the Office of Indian Affairs.

Office activity resulted in the addition of 91,240 acres to power-site reserves and the elimination of 5,075 acres, increasing the outstanding reserves in 22 States and Alaska to a net total of 6,860,462 acres; in the preparation for publication of maps of 300 miles of river channel; in final action involving hydraulic determination on 307 cases received for report from departmental sources and the Federal Power Commission and in water-power classification on 2,831 cases, which also involved mineral classification.

Investigations and studies were in progress involving the power and storage possibilities of 36 rivers. Reservoir-site reserves in nine States remain unchanged at 137,172 acres.

A regional office in charge of a district engineer was reestablished during the year at Sacramento, Calif.

Mineral Lease Supervision

Mine supervision.—The Mining Division administers the mining operating and safety regulations under the respective mineral leasing acts providing for the exploration, development, and mining of mineral deposits on public domain and Indian lands in the United States and Alaska, and in accordance therewith supervises mine operations, including prospecting, development, and production of coal, potassium, phosphate, sodium, silica sand, oil shale, and sulfur on public lands; of gold, silver, mercury, vanadium, and quartz on various land grants; and of all minerals, except oil and gas, on segregated, restricted, allotted, and tribal Indian lands. The production of minerals from public and Indian lands continued at war-time rates to meet the industrial and civil needs for reconversion to a peace-time economy. The total mineral output during the year was valued at more than \$66,000,000.

The Division, in the performance of its functions, provides technical service and assistance to the Office of the Secretary of the Interior, the Office of Indian Affairs, and the Bureau of Land Management in the administration of mineral leases, permits, and licenses, and related problems. It also serves as consultant to the Department of Agriculture on mining permits and leases under the jurisdiction of that Department and supervises production of minerals from public lands by the Metals Reserve Company and the War Assets Administration, successor to the Defense Plant Corporation. Under supervision as of June 30, 1946, were 555 properties on public-domain land under lease, permit, and license; 235 properties on Indian land under lease or mining permit, in 14 States and Alaska; and 3 secretarial authorizations in 2 States.

The mining Division cooperated with the Departments of War, Justice, and Agriculture, other Bureaus of the Department of the Interior, the War Production Board, the Reconstruction Finance Corporation, and the War Assets Administration on the administration of mineral leases and inter-related problems and is designated as an agency for determining the relative merits of applications for access roads to be built by the Public Roads Administration of the Federal Works Agency and to provide the Smaller War Plants Corporation with factual data on mining properties on the public domain for use in consideration of loan applications.

The production of potassium continued to increase under the impetus of the demand for food production both at home and abroad. More than 99 percent of the national output is produced by four Government lessees, three in New Mexico, one of which operates on public and State land, and one in California, which operates on public and fee land. Prospect drilling in advance of mine development in New Mexico during the year has added

substantially to known reserves. Drilling by the International Mineral & Chemical Co. disclosed an entirely new area southwest of its present operations potentially as valuable as the one on which it is now operating. The only other known undeveloped commercial deposits of potash in New Mexico is contained in a Government reserve created by Executive Order No. 6797 of July 27, 1934.

Phosphate production also reflected the demand for fertilizer materials to increase food production. The output from public domain increased 70 percent over the previous year, and further increase is anticipated as phosphate leases recently issued get into production. The suspension of action on the issuance of phosphate leases under Departmental Order No. 1294 of July 2, 1938, except in particularly meritorious cases, continues in force.

Most of the output of sodium products from public domain is from Searles Lake, Calif. Refined salts from that source include potassium, borax, soda ash, salt-cake, bromine, burkite, and sodium lithium phosphate. During the war these chemical products were utilized in the manufacture of war materials, such as percussion caps, bombs, flares, shells, smokeless power, synthetic rubber, armor plate, range finders, bomb sights, and fire-control apparatus. Sodium products are also used in the production of glass, enamel ware, porcelain, soaps, medicines, ferrous alloys, kraft paper, and flame-resisting paints and fertilizer, water treatment, cleaners, and numerous other purposes for which consumption is expected to continue at war-time rates.

Production of lead and zinc from Quapaw Indian lands in Oklahoma amounted to about 7 percent of the national output, considerable less than prewar production. To an appreciable extent the decrease can be attributed to the over-all labor shortage, but the main factor was a continuing depletion of high- and medium-grade ore reserves. Study of the ore reserves on Quapaw Indian land initiated in 1944 were continued as an aid in maintaining production and to obtain information as to the probable reserves of low-grade ore that may be amenable to mining by large-scale mechanized operation.

Other minerals produced from Indian land included coal, tungsten, manganese, vanadium, uranium, limestone, gypsum, and sand and gravel.

Oil and gas supervision.—The Oil and Gas Leasing Division supervises operations for the discovery and production of petroleum, natural gas, gasoline, and butane occurring in public lands of the United States, in naval petroleum reserves, and in all Indian lands subject to Departmental jurisdiction, both tribal and allotted, except those of the Osage Nation, in Oklahoma. During the year these duties were accomplished through 18 field offices and suboffices in California, Colorado, Montana, New Mexico, Oklahoma, Utah, and Wyoming.

Owing to the necessity of absorbing increased costs of Public Law No. 106 there were numerous separations of personnel, which vitally affected

programmed work on secondary-recovery studies. The four special study groups, which were engaged in this timely investigation in aid of secondary recovery operations and other engineering practices necessary to conservation and maximum ultimate recovery of petroleum from public and Indian land leases, were necessarily inoperative during a major portion of the year, resulting in the issuance of but one published report and the suspension of work on seven others in various stages of completion.

On public lands, 8,750 oil and gas properties were under supervision at the end of the fiscal year, aggregating 6,034,397 acres in 20 States and Alaska, an increase of 24 percent in the number of properties and nearly 31 percent in the acreage under supervision at the close of the previous fiscal year.

Drilling on public lands during the year included the spudding of 496 wells and the completion of 550 wells, 386 of which were productive of oil and gas and 164 of which were barren. In all, 12,124 public-land wells, including 6,589 capable of oil and gas production, were under supervision on June 30, 1946. The production from petroleum deposits of the public lands during 1946 was somewhat more than in 1945.

Activities toward unitization of oil and gas operations involving Federal land were reflected in an increase of 2 in the number of new unit plans approved during the year, the total being 24; 69 unit plans were terminated, leaving 131 approved plans covering 1,722,022 acres outstanding on June 30, 1946. Production under approved unit agreements constituted about 54 percent of the petroleum obtained from public lands during the year, 65 percent of the natural gas, and 75 percent of the gasoline and butane. In addition 2 Indian-land unit agreements covering a gross area of 36,710 acres were in effect during the year.

On Indian lands the work of oil and gas lease supervision involved 4,931 leaseholds in 10 States, containing at the end of the year a total of 7,525 wells, 4,042 of which were productive of oil or gas and 163 of which had been completed during the year.

On behalf of the Navy Department supervision was continued over operations for the production of oil, gas, gasoline, and butane from 21 properties under lease in Naval Petroleum Reserves Nos. 1 and 2 in California. Production from 286 active wells on this reserve aggregated 3,918,600 barrels of petroleum, 3,890,000,000 cubic feet of natural gas, and 9,313,000 gallons of natural gasoline and butane, having an aggregate royalty value of \$727,328.

On War Department lands in the Rio Vista gas field the work included the consideration and approval of a number of the revisions in participating percentages for these lands and the computation of royalties due the United States on the gas production allocated to the lands in the amount of 4,397,930,000 cubic feet with a royalty value of \$190,600.

Work on Publications

Texts.—During the year, 59 publications were issued, as follows: Professional Paper 205-B; Bulletins 943-C, 945-E, 946-A, B, C, D, E, 947-A, 949; Water-Supply Papers 889-F, 965, 967-A, B, C, 970, 971, 972, 973, 975, 976, 982, 987, 990, 991, 1004, 1007, 1009, 1010, 1011, and 1014; Geologic Atlas of the United States, Folio 227; Monthly list of new publications, Lists 448-459; and 15 index circulars. These reports cover 6,940 printed pages. Work by the editors included the following: 4,602 pages of manuscript edited and prepared for printing; 516 galley proofs and 2,655 page proofs revised and returned; indexes prepared for 12 publications, covering 923 pages, and consisting of 3,777 index entries. Copy edited in preparation for mimeographing included 15 press releases, consisting of 25 pages, and 72 pages of miscellaneous material.

Illustrations.—Drawings and photographs numbering 578 for 29 reports were transmitted for printing by the customary processes—chromolithography, photolithography, halftone, zinc etching, collotype, and offset. In addition 15 maps and sections showing the results of cooperative investigations in the American Republics were prepared for preliminary release. Seven hundred sixty-nine proofs and twenty-four edition prints were examined.

Geologic maps.—During the year, 482 geologic maps, charts, diagrams, and other illustrations were prepared by the Section of Geologic Cartography for black-and-white and multicolor reproduction. Work on Geologic Folio 228, Hollidaysburg-Huntingdon, Pa., was completed, and the folio was delivered in June. The geologic map of Idaho, to be printed in 16 colors, was sent to the Division of Map Reproduction, and the geologic map of Washington and vicinity is ready to be transmitted. Of the maps in the Missouri Basin series, 6 were printed, 3 others were completed, and 4 are now being drafted. Other geologic maps published or in various stages of preparation are colored maps of Zion Monument and Iron County, Utah; a black-and-white map of the State of Utah; a colored map showing chromite deposits of Del Norte County, Calif., published by the State; and 9 quadrangles of the Coast Ranges in California, to be published by the Geological Society of America.

Because of the development of the new cellophane stick-on patterns prepared from the Geological Survey's own geologic pattern plates, color plates for all but the most complicated geologic maps can now be prepared by sticking on the patterns. Publication is thereby greatly expedited.

In addition to editing the maps and other illustrations prepared by the Section of Geologic Cartography, the Geologic Map Editor critically reviewed 136 maps and figures prepared in the Section of Illustrations for Professional Papers and Bulletins; 26 maps prepared for Water-Supply Papers; 70 maps and figures drafted in the field and section offices for outside publication; 51 maps and figures planned for Survey publication but

not yet drafted; and 27 mineral resources maps to be issued jointly by the Geological Survey and the Bureau of Mines.

During the year, plans were completed for issuing a new series of multi-color geologic quadrangle maps. The explanations on these maps are to be expanded sufficiently to describe the rock formations, and for some maps a brief explanatory text will be printed on the same sheet. In addition to the regular geologic maps, this series will include glacial geology maps, engineering geology maps, and other special maps.

Map Reproduction.—During the year the Division of Map Reproduction printed 1 geologic folio, 59 newly engraved topographic maps, 143 multi-color topographic maps, 13 planimetric maps, 51 preliminary geologic maps, and 6 special maps, making a total of 273 new maps printed and delivered. Reprint editions of 292 engraved topographic maps, 7 multicolor maps, and 122 photolithographed State geologic maps and planimetric, preliminary, and other maps were printed and delivered. Of new and reprinted maps, 694 different editions, amounting to 1,712,610 copies, were delivered.

A large amount of work was done for 70 other units of the Government, including branches of the Geological Survey and States; the charges for it amounted to about \$160,000, for which reimbursement was made to the appropriation for engraving and printing geologic and topographic maps. 90 transfer impressions and velox prints were made during the year, and the amount turned over to miscellaneous receipts was \$777.32.

The total number of copies of topographic maps and contract and miscellaneous work of all kinds printed and delivered was 4,014,657.

The photographic laboratory made 7,400 negatives, 30,840 prints, 3,366 photolith press plates, 102 intaglio etchings, and 7 celluloid transfers and mounted 632 prints.

Distribution.—The Division of Distribution received during the year a total of 722 publications, comprising 36 new book reports and pamphlets and 3 reprints; 51 preliminary maps and charts in the series of strategic minerals investigations; 222 new or revised topographic and other maps (10 of which were first published as preliminary editions); 2 Tennessee Valley Authority maps with contours; 408 reprinted maps (topographic, advance sheets, and planimetric); and 1 new geologic folio (No. 227). The total units received numbered 56,720 books and pamphlets (including reprints), 56,765 copies of revised index maps, 1,656,185 topographic and other maps, and 4,540 geologic folios, a grand total of 1,774,210.

The division distributed 66,607 books and pamphlets, 650 geologic folios, and 1,154,793 maps, a grand total of 1,222,050, of which 580 folios and 991,659 maps were sold.

The net proceeds from sales were \$69,016.69 for maps and \$192.25 for geologic folios. In addition \$11,007.75 was repaid by other Government agencies for maps or folios furnished. The total net receipts, therefore, were \$80,216.69. Since the cessation of hostilities the general public appears to be more map conscious. Local sale of maps to private individuals

jumped from \$3,406.26 to \$5,747.09, which meant rendering service to nearly 6,000 people. The division handled 46,583 letters, an increase of 11,272.

Library

The end of hostilities, with the resulting change in the direction of activities of the Geological Survey, is reflected in the work of the library. The work of the Military Geology Unit, which required the major part of the time of the library staff during the war, has continued, but at a diminishing rate; work in the domestic field has increased. More than 15,000 books, pamphlets, and maps were loaned to Survey personnel for use outside the library, and reading room circulation was over 36,000. Interlibrary loan activity declined but was still heavy; 3,022 books were loaned to other libraries, and 661 books were borrowed. Total circulation was 67,720.

New books, pamphlets, periodicals, and serial parts received numbered 12,037; new maps and charts, 721. Still unable to buy much from abroad, the library spent a considerable part of its book fund for the year in building up its reference collection on physics, chemistry, mathematics, and electronics, to supply new material needed in connection with the Survey's expanded work in those fields.

Foreign exchanges material has begun to arrive from countries formerly cut off from communication, and the Geological Survey has resumed the sending of its publications to libraries sharing in the exchange. The librarian has participated in conferences by Federal libraries interested in the acquisition of foreign texts and maps and has cooperated in the formulation of plans, some of which have been put into operation.

The Bibliography of North American Geology, 1942 and 1943, published as Bulletin 949, was delivered, and the compilation of the succeeding volume covering 1944 and 1945 was completed.

Field Equipment

The Division of Field Equipment has produced relatively few new items of equipment during the past year, for the reason that the essential maintenance and repair work of the Bureau has absorbed practically all of its production capacity, and work on new developments was necessarily curtailed. The only new item of interest consisted of a stereoscope containing only a single prism in the optics thereof. Geologists have found that this stereoscope is particularly convenient for viewing stereoscopically 9- by 9-inch aerial photographs in the field. It consists of a pair of hinged covers 10 inches square that can be opened to an angle of 120° only. As the covers are opened, an adjustable rod bearing the prism rises to a position midway between the two covers and about 9 inches from the center of each photograph. The stereoscopic pair of photographs are attached by means of suitable clips to the inside of the covers—one photograph to

each cover. The arrangement is such that when the observer places his left eye over the prism and looks down, the photograph on the cover immediately below is observed with his right eye, while that on the opposite cover is observed with his left eye through the prism. The field of this special prism is so large that the entire usable portion of the photographs can be seen stereoscopically without readjusting the photographs. In its present form no magnification is provided. Because the lower photograph is completely free from obstructions, details and important points can be easily selected and marked thereon. Another convenience is that the device provides a light, compact, and portable carrying case for the photographs. Persons afflicted with certain eye defects that have prevented them in the past from using ordinary stereoscopes will find it possible to use stereoscopes of this type without difficulty.

Funds

During the fiscal year 1946 there was available for obligation under the direction of the Geological Survey a total of \$15,106,774. Of this amount \$7,407,605 was appropriated directly to the Geological Survey, and \$7,699,169 was made available by other Federal agencies, and by States and their political subdivisions. In addition, \$13,000 was allotted from the appropriation for contingent expenses of the Department of the Interior for miscellaneous supplies.

Funds available to the Geological Survey in 1946 from all sources

Administrative salaries and expenses:

Interior Department Appropriation Act.....	\$218, 560	
Supplemental appropriation	27, 750	
		\$246, 310

Topographic surveys:

Interior Department Appropriation Act.....	2, 146, 560	
Supplemental appropriations	135, 540	
States, counties, and municipalities.....	559, 042	
Bureau of Reclamation.....	677, 000	
Public Roads Administration.....	45, 524	
Navy Department.....	16, 063	
Tennessee Valley Authority.....	75, 000	
War Department	1, 363, 592	
Miscellaneous repay.....	68, 033	
		5, 086, 354

Geologic surveys:

Interior Department Appropriation Act.....	1, 187, 500	
Supplemental appropriation	800	
States, counties, and municipalities.....	86, 100	
Bureau of Reclamation.....	265, 000	
Navy Department.....	13, 900	
War Department	555, 102	
Republic of Chile.....	11, 102	
Miscellaneous repay.....	19, 398	
		2, 138, 902

Funds available to the Geological Survey in 1946 from all sources—Con.

Strategic and critical minerals:		
Interior Department Appropriation Act.....	\$325,000	
States, counties, and municipalities.....	14,000	
State eta sh cm cmfwyp cmfwyp.....	129,859	
		\$468,859
Mineral resources of Alaska:		
Interior Department Appropriation Act.....	157,500	
Navy Department.....	117,890	
War Department.....	75,000	
		350,390
Gaging streams:		
Interior Department Appropriation Act.....	1,787,200	
Supplemental appropriation.....	321,100	
States, counties, and municipalities.....	1,676,144	
Permittees and licensees of Federal Power Commis- sion.....	41,580	
Department of the Interior:		
Bureau of Reclamation.....	520,266	
Office of Indian Affairs.....	6,145	
Office of Land Utilization.....	17,995	
State Department.....	87,221	
Tennessee Valley Authority.....	61,000	
War Department.....	609,920	
Miscellaneous repay.....	21,606	
		5,150,177
Classification of lands:		
Interior Department Appropriation Act.....	213,400	
Supplemental appropriation.....	800	
States, counties, and municipalities.....	2,500	
Bureau of Reclamation.....	278,797	
		495,497
Printing and binding: Interior Department Appropriation Act.....		101,500
Preparation of illustrations:		
Interior Department Appropriation Act.....	29,230	
Supplemental appropriation.....	2,110	
		31,340
Engraving and printing geologic and topographic maps:		
Interior Department Appropriation Act.....	263,210	
Miscellaneous repay.....	160,500	
		423,710
Mineral leasing:		
Interior Department Appropriation Act.....	484,100	
Office of Indian Affairs.....	99,200	
Navy Department.....	20,000	
Miscellaneous repay.....	4,690	
		607,990
Arkansas River Compact: First Deficiency Appropriation Act.....		2,371
Payments from proceeds of sale of water, special account.....		3,374
Total funds available.....		15,106,774

Solid Fuels Administration for War

DAN H. WHEELER, *Deputy Administrator*



THE Solid Fuels Administration for War opened the 1945-46 fiscal year faced with the job of providing enough coal and coke to hasten the defeat of Japan. Solid fuels, at that time, were still short even though Germany had been defeated.

After victory over Japan, coal requirements receded slightly. Then followed a wave of strikes. Production losses became serious. Before the end of the year the Nation's coal supply was cut by strikes about 30,000,000 tons. Special-purpose coals were critically short.

When relief came to the national market, pressure was brought for more export coal. The liberated nations of Europe had to be supplied. SFAW was called upon for quantities of lower grade coals for this need. At the same time scarce and higher grade coals had to be held from export.

Late in autumn, with the resumption of mining and increased production, SFAW began to revoke controls over distribution. This was done as fast as possible.

Plans were made for liquidation by the end of the fiscal year. However, because of the terrific loss of coal caused by strikes in the spring of 1946, the industry itself requested that SFAW be continued and this was effected. It went into action again as prospects for the 1946-47 winter were not too bright.

Between the Surrenders

The end of hostilities in Europe found the United States with a serious deficiency in high-grade coals, a continuing manpower shortage in the mines, handicapped for lack of equipment and replacement parts for machinery, and the consequent continued need for regulation of distribution, to speed the fall of Japan and prevent hardship to consumers.

Shortage of manpower, the most serious wartime problem of the coal industry, was not relieved for many months. SFAW continued efforts to recruit labor and to have miners deferred by Selective Service. Moreover, many miners had gone to other war industries paying higher wages, and strikes further curtailed production. SFAW assisted in wage negotiations between the operators and the United Mine Workers of America, and took over the mines until wage contracts had been signed. At times, insuffi-

cient supplies of meat caused dissatisfaction among the miners, resulting in sporadic strikes and high absenteeism. In some areas railway coal cars continued in short supply.

In June 1945, 260 bituminous coal mines were returned by SFAW to their owners. Included were two properties of the Jewell Ridge Coal Corporation at Tazewell, Va., which had been in Government possession since November 1, 1943, due to failure of miners and operators to agree to the terms of the national bituminous wage agreement, and pending litigation over portal-to-portal pay. After the United States Supreme Court had ruled in the case that travel time is work time, the company signed the 1945 contract and the two mines were released. Three soft coal mines of the Carter Coal Co. at Coalwood and Caretta, W. Va., were retained in Government possession until March 28, 1946, because operators and workers had no contract. Termination of possession of the anthracite mines, taken over May 4, occurred on June 23, 1945.

At the commencement of the fiscal year, SFAW warned the Nation that a recent survey indicated requirements for the fuel year exceeded anticipated production by about 37,000,000 tons, of which 25,000,000 tons were bituminous coals needed by the industries. It was predicted also that coke would be in short supply as a home-heating fuel because of heavy demands by the steel plants.

During the summer SFAW, aided by the industry, conducted a conservation campaign. An envelope-stuffer entitled "All fuel is Scarce—Warns United States Government" was issued late in June. This was followed later by a circular entitled "Prepare for Winter," which emphasized winter-proofing of houses by installation of storm doors, caulking, insulation, and the application of other heat conservation devices. Fuel conservation directors of 25 States were urged to launch local drives.

After the fall of Germany, reporting provisions of the regulations were modified. Lignite distribution was released from control. However, rice anthracite (Buckwheat No. 2) became scarce and was included with the larger sizes in a 90 percent limitation on retail deliveries, based on the consumer's normal annual burn. Until mid-August, summer deliveries of anthracite and byproduct coke were limited to 50 percent of annual quotas. Suppliers were required to meet their full commitments of coal for the Army, Navy, Maritime Commission, and Veterans' Administration. Overseas shipments of American-mined coals were prohibited without specific approval from SFAW. Early in September commitments of coal moving to industrial consumers via the Great Lakes were curtailed 5 percent.

Autumn Strikes Retard Recovery

Following the surrender of Japan, restrictions on deliveries by retail dealers were removed. Control of distribution was confined to the wholesale level. It was felt that shortage of preferred domestic fuels could now

be relieved by the increased supplies of usable lower grade coals. In September, with the Lakes navigation season nearing an end, preference in shipments of high grade coal to part of that region was required, to make up for early Lakes season deficiencies.

During the summer a series of strikes caused an estimated production loss of approximately 8,000,000 tons of bituminous coal, and about 3,600,000 tons of anthracite. On September 21 a widespread supervisory strike began in the eastern bituminous districts. It continued until October 17, with an estimated loss of 15,000,000 tons. The Government did not take over the mines, but during the strike SFAW issued emergency restrictions on shipments of coal produced in four major eastern mining districts, coal being released only to the most essential users. As the supply for the Great Lakes area was threatened, shipments by the upper Lakes dock operators were restricted to essential consumers.

Wartime Controls Relax

With the end of the supervisory strike, production gradually rose to a high level. Western-mined coal being in good supply, SFAW closed five of its western field offices, but retained offices in St. Louis and Minneapolis. Reporting requirements for mines west of the Mississippi River were removed. Emergency strike restrictions were lifted, and four orders of preference was set up for shipments of scarce eastern-mined soft coals: (1) to part of the Great Lakes area; (2) shipments of special purpose coals; (3) to retail dealers, and (4) to the remainder of the Lakes area. Most of the wartime controls over anthracite and coke were canceled, but retail dealers were directed to distribute their available supplies equitably. As domestic consumers could hardly hope to obtain their full supply of better grades, they were urged to make up the deficiency with inferior grades of solid fuels.

Supply to the upper Great Lakes continued behind schedule, so movement of coal to that area was accelerated while shipments of certain southern Appalachian coals to the lower Lakes ports were prohibited until the close of the navigation season, to be made up later by rail. Industrial stockpiling of district No. 8 coal, produced in Virginia, southern West Virginia, eastern Kentucky and northeastern Tennessee, was placed under strict control during November, in order to increase the supply for the retail trade and for industries with very low reserves. The restriction did not apply to Lakes shipments.

Fortunately navigation continued on the Great Lakes until December 1. After that date a different order of preference was established to make provision for the changed pattern of distribution, as follows: (1) Special purpose coal; (2) retail dealers' quotas; (3) additional shipments to the retail trade; (4) permission for a 60-days' stockpile supply, except of scarce southern Appalachian coals, and (5) a stock limitation table for those coals.

Any surpluses of southern Appalachian coals, after commitments had been met by producers, were reported to SFAW, which then directed their distribution. Heavy seasonal shipments to the Great Lakes area had left the Southeast short of coal for the winter, and SFAW now directed coal into that area to make up deficient quotas.

By the first of the year, coal produced in the Midwestern States was in short supply, and shipments to industrial consumers having more than 20 days stock were reduced in order to provide more coal for retail yards and the harder-pressed industrial consumers. Commercial dock operators on the Great Lakes were required to schedule their shipments to retail dealers as a means of detecting surpluses which could be diverted to communities in acute need of fuel. Early in February, 1946, shipments of domestic soft coal to army camps were stopped for the remainder of the month, as they appeared to have sufficient supply, and the coal saved was diverted to the retail trade.

In February, with the liquidation of SFAW in mind, the agency announced that during the next fuel year, beginning April 1, producers, distributors and consumers would be free to make their own agreements for fuel purchases. At that time it was contemplated that SFAW would exercise until June 30 only emergency controls and a limited supervision of exports. Reporting to SFAW, however, was to be continued.

On March 20, "surplus" coal was permitted to move via the Great Lakes without restriction, in anticipation of an early spring. At the end of the coal year, March 31, other restrictions on Lakes movement were revoked along with certain other orders. Regulations covering special coal and dealer receipts of Utah coal expired automatically and were not reissued. Regulations remaining in effect at the beginning of the new fuel year were those empowering SFAW to issue specific directions providing for the distribution of solid fuels, to supervise exports, and to subject solid fuels in transit to reconsignment, diversion, or rerouting in emergency. Orders which called for certain reports were retained, as were those establishing industry advisory committees.

1946 Strike Revives Need for SFAW

Immediately after the issuance of the order which revoked many of the controls, a threatened strike of bituminous coal miners called forth two emergency orders, one freezing on mine track the equivalent of one full day's production for direction to avert crises, and the other limiting deliveries by retail dealers and dock operators to certain essential classes of consumers. For the first time since the close of the supervisory strike in the autumn, SFAW again stressed the importance of the utmost conservation of existing stocks.

The strike in the bituminous coal mines began on April 1, after negotiations had failed since March 12 to result in an agreement between operators and workers. With the exception of a 2 weeks' truce during May, the strike continued until June 3, after the Government had taken over the mines, and had established a new Coal Mines Administration. Formal possession of the mines was taken on May 21.

Preceding the strike, production during March was estimated at 56,800,000 tons, the largest output for a calendar month since March 1927. Stocks in consumers' hands on April 1 were estimated at 58,700,000 tons, the largest since December 1, 1944, but these were unevenly distributed. By June 1, although production in May amounted to 20,420,000 tons, stocks had dwindled to about 31,642,000 tons—much lower than at any time during the war. This draw-down in stockpiles of about 44 percent as a result of the strike, put the Nation's reconversion from a war to peace economy in a precarious position.

While the SFAW was continued beyond its intended liquidation date, principally to be available if a strike occurred, with the continuance of the strike it began to appear that a serious coal shortage would face the Nation in the winter of 1946-47, and the need for further control by the Solid Fuels Administration was stressed by large and important elements interested in the production, distribution and use of coal. Later, under strong urging by the industry itself, it was decided to prolong the life of the agency. While a number of the staff and personnel had resigned to return to the industry or to accept other employment, and while a number of the field offices had been closed, the remaining staff immediately set about the task of distributing the available coal.

The loss of potential production of about 81,500,000 tons of coal during the long strike was nearly six times greater than the strike loss in the preceding autumn, and nearly three times greater than all losses in the preceding year—losses which at that time seemed ominous enough. On May 1, the Progressive Mine Workers of America, located for the most part in Illinois, went out on strike, and early in June there followed a brief strike in the Pennsylvania anthracite mines. SFAW followed its former policy of freezing one full day's production at the Progressive Mine Workers' mines, to be held on mine track for emergency distribution. Confiscation of any coal subject to distribution by SFAW on the part of railroads or other consumers was prohibited.

On May 7 further restrictions of distribution by retail dealers and dock operators were issued, limiting deliveries to certain essential classes of consumers, including public utilities, hospitals, other important industrial users, bunker fuel for vessels, and domestic consumers having less than five days' supply. Powers of SFAW area distribution managers were extended to expedite action at points in the field. The Interstate Commerce Commission

issued a service order, later extended, deferring demurrage charges for coal held on mine track by SFAW.

Effect of Strike on Utilities and Industry

When the strike began on April 1, about 200 utilities, including electric power companies, had between 20 and 30 days' supply of coal on hand, another 200 had from 10 to 20 days' supply, and 100 had 10 days' supply or less. From the last week of April on, many utilities filed urgent requests with SFAW for coal. On April 30 the Administrator requested companies producing manufactured gas immediately to make use of substitute fuels in order to keep in operation.

Unbilled coal frozen on mine track and at weigh scales on the eve of the strike totaled about 1,650,000 tons. During April 713,300 tons of this were distributed by SFAW. When the truce started, only about 650,000 tons remained.

The frozen supply was so limited that none of it could be released to general industries. Some of these had very low stocks owing to their limited storage space, and they had been relying on day-to-day deliveries. Many industrial consumers not in the preference group had to retard or even suspend operations. A number of steel plants, paper mills, and other important industries closed down. During April the over-all consumption of soft coal dropped 25 percent. After mining was resumed it required several weeks for these plants to return to normal operation. At the request of SFAW, some consumers with substantial stockpiles shared with others in the community who were in less fortunate position.

In the course of the strike, the Office of Defense Transportation ordered the railroads to curtail passenger service by 25 percent, and an embargo was placed on nonessential freight. A survey on April 29 of 64 principal railroads consuming bituminous coal showed that their stocks had been cut in half since April 1. When the truce began, embargoes were lifted.

Many cities prepared to order brownouts or dimouts, and some went into effect shortly before the truce. Probably Chicago felt the greatest need for conservation of limited supplies. New York, Detroit, Philadelphia, Newark and many smaller cities also ordered brownouts. The truce made these of short duration, however, but even during the two weeks' truce, production did not return to normal.

On May 31 an interim "notice of direction" was issued, setting up three preference groups for shipments of bituminous coal from mines resuming operation, as follows: (1) Public utilities, railroads, hospitals, food processing plants, dairies, commercial bakeries, refrigeration plants, and laundries; (2) other industries, and (3) domestic consumers with less than ten days' supply, later increased for those having storage facilities. Strenuous efforts were made to move coal to the Great Lakes area, the navigation season having been greatly shortened by the strike.

At the close of the fiscal year, the interim notice of direction was replaced by the issuance of a new regulation covering the distribution of bituminous coal, and designed to increase its movement to the Lakes. It was applicable only to coal produced east of the Mississippi River. After Great Lakes commitments, a second preference was given to retail dealers. A third preference, to industries, prohibited unnecessary stockpiling until the close of navigation on the Lakes.

Coal for Liberated Nations

Shortly after the defeat of Germany appeals for American coal came from the liberated nations of Europe. Mining had been seriously disrupted by the war on the European continent. Manpower was short and food was scarce for those available for work. Transportation in the liberated countries was in chaotic condition, canals upon which coal was carried in peacetime were impassable, and railroads and rolling stock were in disrepair. Investigation disclosed that the greatest possible quantities of coal from the United States would have to be shipped to Europe in order to aid public utilities and essential industries, and prevent extreme hardship for the peoples.

In May 1945, the then Deputy Solid Fuels Administrator, Charles J. Potter, met the British coal representative, Lord Hyndley, and others, and they investigated the situation in Europe. The report of the Potter-Hyndley Mission, as it was termed, confirmed the alarming condition of the liberated nations and their immediate need for coal. The Secretary of the Interior decided in July to go ahead with an export program which specified that 6,000,000 gross tons of coal would be shipped between August 1 and January 1, if possible. SFAW exercised careful control over coal made available for export.

When a program to operate under the Procurement Division of the United States Treasury had been set up to undertake this task, the representatives of nine European governments sent to the United State Government, on August 11, a formal expression of gratitude. The rapid increase of strip mining in this country during the war provided a surplus of low-grade coals, usable but not in demand by American buyers, which with some run-of-mine sizes and some anthracite fines could be shipped to Europe without causing undue hardship in this country. A small quantity of special-purpose coals for gas plants was permitted to be shipped.

For the most part coal for export was purchased through agents of the United States Treasury and paid for by the recipients. A relatively minor tonnage was shipped on lend lease accounts until the discontinuance of that program. Quotas for particular nations were established by the Combined Coal Committee with the advice of the European Coal Organization. SFAW issued directions for producers to supply sufficient tonnages to meet the quotas. Neutral nations were required to shop in the open market. In

spite of the foreman's strike in October, the difficulty of obtaining crews for ships, tugboat strikes and other transportation difficulties, the export of approximately 8,000,000 gross tons of coal was accomplished by mid-February. The level of shipments reached more than 2,000,000 gross tons by March and except for the interruption of the strike have since continued. SFAW not only aided the Treasury Department in finding coal for export, but effected an orderly loading of vessels to prevent unnecessary use of railroad cars and congestion at the ports.

Keeping Track of the Coal

Under an arrangement with the Bureau of Mines, that agency processed all statistical data obtained pursuant to SFAW orders. Mine running-time records were compiled daily by SFAW, enabling the agency to keep account of strike and other losses in production. Current records were provided on production, distribution, consumption and stocks. Current records on costs and prices collected and maintained by the Office of Price Administration were coordinated with other statistical material for use in advising on price matters. Estimates were made on probable production and requirements to indicate the future demand-supply situations.

Compliance Problems Few

Considering the enormous tonnage of coal produced during the war, and the great number of suppliers involved—producers, wholesalers and retail dealers—compliance with SFAW regulations, orders and directives was splendidly carried out by the industry. One reason for this was the fact that SFAW consulted with the industry in preparing the regulations and kept in close relationship with it at all times.

Compliance officers in the field made periodic checks of coal suppliers, and investigated all rumors of violation. Minor violations were disposed of in the field. All cases of serious violation were referred to the Washington office for review.

During the 1945-46 fuel year, about 550 warning letters were issued, more than half of them in the spring of 1945. In most cases a warning was sufficient, many violations resulting from the fact that the recipient did not fully understand the regulations or know that he was violating them. A total of 61 prohibition notices was issued during the year, and only seven suspension orders. The prohibition notices were lifted when compliance was assured, and the suspension orders were revoked when general controls were removed.

Two cases of continued violation came before a court in Brooklyn, N. Y. The defendants were found guilty and penalized. They pleaded that the regulations were unconstitutional, but the court upheld the constitutionality of the Solid Fuels Administration's regulations.

Prospects for the 1946-47 Winter

With production losses in the spring greater than any caused by strikes during the war, with shipments to the Great Lakes lagging in early June some 9,000,000 tons behind schedule, and with a heavy European demand for export coal, the best production anticipated for the remainder of the fuel year will be barely sufficient to meet requirements, without any provision for stockpiling. It is anticipated that some coal can be shipped all-rail to the Great Lakes area, but sufficient railroad cars will not be available for long hauls of heavy tonnages. Moreover, not all of the Lake buyers have facilities to take their coal by rail. The prospect for domestic consumers is that they will not be able to obtain their normal annual supply in the better types of domestic coal and coke, but will have to supplement their supplies with some of the lower grades. Higher grades of southern Appalachian bituminous coals will continue in short supply for many months to come. Rebuilding the stockpiles of the Nation to prewar strength will be a very slow process.

Oil and Gas Division

RALPH K. DAVIES, *Acting Director*



Genesis and Purpose of New Division

THE need for coordinating in peace time the many interests of the Federal Government in petroleum, petroleum products and associated hydrocarbons, for providing a focal point of leadership and information for the numerous agencies of the Government dealing with petroleum, and for unifying the Federal policy with respect to the functions and activities related to petroleum carried on by the various Departments and agencies was recognized by the President when he ordered (Executive Order 9718) the termination of the Petroleum Administration for War, which had been the central agency in oil matters during the war. In a letter of May 3, 1946, the President requested the Secretary of Interior "to undertake the initiative in obtaining coordination and unification of Federal policy and administration with respect to the functions and activities relating to petroleum carried on by the various Departments and agencies." He stated the policy that "where practical and appropriate, governmental activities relating to petroleum should be centralized," and he directed that from time to time the Secretary of Interior submit to him "for consideration proposals looking to the accomplishment of this objective."

"Impressed with the great contribution of Government industry cooperation to the success of the war petroleum program" as exemplified by the procedures of the Petroleum Administration for War, and recognizing "the values" in the continuation of "such close and harmonious relations," he suggested the establishment of an industry organization to consult and advise with the Secretary of Interior.

Pursuant to the instructions of the President, the Secretary of Interior, by Order No. 2193 of May 6, 1946, established the Oil and Gas Division which, with a view to the conservation of the oil and gas resources of the Nation and the achievement of petroleum security, is directed to:

1. Assist the Secretary of the execution of the President's instructions to:
 - (a) Coordinate and unify policy and administration in respect to the functions and activities relative to oil and gas carried on by the several Departments and agencies of the Federal Government;
 - (b) serve as the channel of communications between the Federal Government and the pet-

roleum industry; (c) serve as liaison agency of the Federal Government in its relations with the appropriate state oil and gas bodies; and (d) review technological developments in the field of petroleum and synthetic hydrocarbon fuels and coordinate Federal policy with respect thereto.

2. Obtain and analyze information as to oil and gas matters in which the Federal Government has a proper interest and, in this connection, serve as the central Federal clearing house for statistics, technical data, and other information relating to oil and gas.

3. Keep the Secretary informed with respect to the adequacy and availability of supplies of petroleum and its products to meet the current and future needs of the Nation, and with respect to significant developments in the petroleum field, and make recommendations with respect thereto.

4. Develop proposals looking to the centralization of Federal functions and activities relating to oil and gas in keeping with the President's letter.

5. Coordinate all oil and gas policies and activities in the Department of the Interior.

Pursuant to the Executive order of May 3, 1946, terminating the Petroleum Administration for War, the personnel, records, property and funds of the Administration were transferred to the Oil and Gas Division which proceeded to wind up and liquidate the affairs of the Administration.

Upon the issuance of an Executive order amending Executive Order No. 7756, dated December 1, 1937, and the regulations and amendments approved October 27, 1942, for the administration and enforcement of the act of February 22, 1935, as amended, to designate the Oil and Gas Division in lieu of the Petroleum Conservation Division, the Oil and Gas Division assumed all the authority and duties of the Petroleum Conservation Division and the funds, personnel, equipment and records of the Petroleum Conservation Division were transferred to it and the Petroleum Conservation Division ceased to exist.

By Executive Order No. 9732, June 3, 1946, the administration of the act of February 22, 1935 (49 Stat. 30), as amended, the so-called "Connally Hot-Oil Act," was transferred to the Oil and Gas Division. The record of the Petroleum Conservation Division and the Federal Petroleum Board, the administrative agencies of the act (49 Stat. 30) for the fiscal year ending June 30, 1946, are reported later in this section.

Immediately upon the issuance of order creating the Oil and Gas Division a skeleton organization was worked out and a request for funds was made to the Bureau of the Budget and the Congress. Simultaneously progress was made in carrying out the direction of the President to create an industry advisory group. In consultation with the former Deputy Petroleum Administrator for War, the Secretary of Interior issued invitations to 85 oil and gas men to membership on the National Petroleum Council which on June 21 held its first and organizing meeting.

*Petroleum Conservation Division and Federal
Petroleum Board*

The Petroleum Conservation Division created by Executive Order 7756, December 1, 1937, was by Executive Order 9732, June 3, 1946, transferred to the Oil and Gas Division. This division during the war was concerned primarily with the administration of the Connally Act as most of its other functions were carried on by the PAW. With the rapid liquidation of PAW functions late in 1945, the Petroleum Conservation Division increased its personnel and again turned to the problems of cooperation with oil and gas producing states in the prevention of waste and keeping informed as to the movement in interstate commerce of petroleum and its products with respect to parity between supply and consumptive demand.

The Federal Petroleum Board established under Secretary's Order No. 1753-A, dated October 27, 1942, is the successor agency of Federal Tender Board No. 1, which was established in 1935. The Board with headquarters at Kilgore, Tex., and suboffices at Houston, Corpus Christi, and Midland, Tex., and Lafayette, La., enforces regulations under the Connally Act in which process it directs an examining force which make physical inspection of production, transportation and processing of petroleum; and investigates and reports on violation of the Connally Act within areas in which there are State laws and regulations concerned with petroleum production.

From within an area which includes 106 counties in Texas, two in New Mexico, and the State of Louisiana, the Board receives reports from more than 1,600 sources. Report requirements on the operation of fields with low well potentials are suspended by the Board when they serve no useful purpose. Elimination of these stripper fields, the Board area from which reports are received includes as of June 1, 1946, 517 oil fields; 55,896 wells; 74 refineries; and 128 gasoline plants. As of June 1, 1946, 436 transporters were reporting to the Board. The reported daily production averages 2,078,514 barrels of oil, which figure includes raw condensate from wells and 132,237 barrels of casinghead gasoline and other liquefied gas from gasoline plants. This production, excluding products from gasoline plants, is about 77½ percent of the total production for Texas, New Mexico, and Louisiana and about 33½ percent of the entire national output. The refineries in the Board area handle 4,104,023 Mcf. of gas daily, most of which comes from oil wells or from condensate wells. Fields reporting oil production to the Board represent about 38½ percent of all fields in Texas, Louisiana, and New Mexico.

During the fiscal year the requirement that production reports be submitted to the Board was suspended in 134 fields and lease-operating detail on Transporter's Reports was suspended in 575 fields. New development made it necessary to reinstate the requirement for production reports in 21 fields and 86 newly discovered fields began submitting reports.

Violations of the Connally Act

As of July 1, 1945, there were nine Connally Act cases which had been referred to the Attorney General, pending action by the Department of Justice, and one civil action which was subsequently concluded favorably to the Board by the Supreme Court of the United States in that writ of certiorari was denied the petitioners. Of these nine cases, six were concluded successfully through prosecution—assessment by the court of fines aggregating \$42,000 and in one instance a suspended jail sentence. One case was continued into the succeeding 1946 term for final disposition, one case was pending trial, and one case remained on the docket of the United States Court at New Orleans awaiting apprehension of the indicted. The above-described proceeding involved 1 corporate and 21 individual defendants. During the fiscal year, 37 major criminal investigations, resulting from numerous special and routine investigations, were initiated to establish violations of the act. Of these major investigations, 26 were discontinued where sufficiency of evidence as to positive violations failed in development. Two completed cases were pending prosecutive action in the Department of Justice at the end of the period, one was under review by the Office of the Solicitor, one was under review by the Director. Seven investigations were in progress at the close of the period. Three of these were sufficiently developed to justify the assignment of case file numbers.

Office of Land Utilization

LEE MUCK, *Assistant to the Secretary*



THE Office of Land Utilization was established in 1940 in the Office of the Secretary as the coordinating agency for the land and water conservation and development programs of the Department of the Interior.

Webster defines coordination as “* * * combination in suitable relation or so as to give harmonious results; functioning of parts in cooperation and normal sequence * * *.” A mechanical device cannot operate unless its parts are coordinated; and organism or organization can operate under such conditions only at reduced efficiency. Coordination in a Government department is a function of the executive of that department, but experience has demonstrated that the “span of control” of one person is so limited that in a large organization a staff, such as the Office of Land Utilization, is necessary for this purpose.¹

Coordination of the land programs of the Department of the Interior involves chiefly the integration of investigations, reports, and plans with respect to timing, coverage, and standards; correlation of general management policies to guard against inconsistencies and to establish uniformity or harmony; prevention of duplication in investigations or operations; and resolution of conflicts between Bureaus and Offices of the Department or between the Department and other land management agencies, concerning areal jurisdiction or management or rights to the use and development of land or water resources.

The principles governing the activities of the Office of Land Utilization have been stated and restated in previous annual reports. Briefly, the Office has proceeded on the theory that the application of the fundamental principles of coordination and cooperation can be effected without overlapping or duplication and without interfering with the administrative authorities of the bureaus operating in the various functional fields. It has earnestly sought to promote unification of action directed toward a common goal through cooperative efforts, dissemination of information, and rendering of efficient advisory service.

¹ See White, Leonard D., *Introduction to the Study of Public Administration*, The Macmillan Co., 1939, pp. 45-47.

Coordination of the land conservation and development programs and policies of the Department in the Office of Land Utilization is a continuing process. It is not achieved overnight through abstract consideration of these programs and policies; it is evolved gradually through day-to-day review of those routine actions of the bureaus which are submitted to the Office; through consideration of appeals to the Department from decisions of these Bureaus; through control of the allocation among the Bureaus of conservation funds appropriated on a Department-wide basis and of the accounting for expenditures of these funds; and through performance of numerous special "trouble-shooting" tasks which come before the Office involving the resolution of conflicts between agencies within the Department or between the Department and outside agencies. Constant devotion to these tasks, both routine and special, reveals the stresses and strains between various departmental programs and policies and the weaknesses in both objectives and performance. It forms the basis for a type of coordination that, although so unspectacular as frequently to go unnoticed, nevertheless is highly effective.

Accomplishments in Coordination

A brief review of the progress heretofore made in the formulation and application of a complete and coordinated program for the Department in the field of land and resource management follows. The specific accomplishments are:

1. The planning of a systematic and orderly program looking toward the conservation of the soil and water resources on all the lands under the jurisdiction of the Department.
2. The development of a more effective forest and range protection program and the coordination of forestry and range-management activities.
3. The development of more unified action in dealing with departmental problems involving the water resources of the Nation.
4. The establishment of sound land classification activities and the clarification of land policies.
5. The harmonizing and adjusting of the respective management programs and the solution of numerous day-to-day management problems.
6. The development of closer cooperation in dealing with other interests and other departments and agencies in the conservation field.

It has been clearly demonstrated that the divergent views of the several agencies which arise from different primary responsibilities can generally be brought into reconciliation. The work so far accomplished has demonstrated the need for still greater expansion of these efforts and a more intensive use of coordinating principles in providing for more systematic and effective administration.

Progress on the departmental program for securing integrated management of the lands and resources under its jurisdiction has been severely

limited by wartime restrictions on nonmilitary operations. Most of the bureaus concerned have operated with reduced personnel and funds under a hold-the-line procedure pending the termination of the war. This situation has not been conducive to progress. It has, however, served to accent the need for close cooperation that will be of material aid in effecting greater progress in the future.

There follows a detailed description of the accomplishments in the respective fields in which the Office of Land Utilization has been the coordinating agency:

Soil and Moisture Conservation

Soil and water are the Nation's most important resources. Food from American soil was an important factor in winning the war and is now playing a spectacular role in preventing starvation of millions of people in war-ridden countries. It may well be one of the most important elements in the foundation of world peace.

Soil and moisture conservation is concerned with the loss of soil and water and with the deterioration of the soil for productive use. The Department of Agriculture estimates that the annual cost to the United States as a result of uncontrolled erosion and water run-off is more than \$3,800,000,000. During the past 5 years the soils of this Nation have been forced to yield more than in any previous period of equal length. They have been taxed to the limit, and the need for their rehabilitation should be readily apparent.

The total land area of the United States, according to the 1940 Census, is 1,905,000,000 acres. Preliminary estimates by the Department of Agriculture show that 1,821,000,000 acres need examination and some treatment to attain the best use of land and to maintain the soil, and that 300,000,000 acres are in critical condition from erosion.

The erosion problem on Department of the Interior lands is more serious, if anything, than the general erosion problem of the country. The 282,000,000 acres under the jurisdiction of the Department for the most part constitute the undisposed remnant of a once vast public domain of almost a billion and a half acres. For many years this part of the Federal estate had little or no management or protection. More than 20 percent of the area is in critical condition, and almost half of it needs treatment to restore it to maximum sustained productivity.

In accordance with the President's Fourth Reorganization Plan of 1940, the Department of the Interior is responsible for carrying on a soil and moisture program on the lands under its jurisdiction. During the past 5 years, 4 of which were war years in which operations were carried on under a reduced budget, the accomplishments have been limited but definite in scope.

The erosion problem on all the lands under the jurisdiction of the Department has been segregated and it has been determined with reasonable ac-

curacy that 60,000,000 acres are in a stage of critical erosion; 73,000,000 acres are moderately to severely eroded; and 149,000,000 acres show signs of slight to moderate erosion. Of the 60,000,000 acres in critical condition, erosion has ruined 14,000,000 acres for production; 21,000,000 acres are submarginal; and 25,000,000 are marginal.

Plans have been made and project operations initiated looking to the control of erosion forces on the 60,000,000 acres of severely to critically eroded land, and progressive conservation treatments have been initiated on approximately 11,000,000 acres of these lands.

An increasing awareness has been developed among land administrators of the dangers from erosion, with a resulting improvement in land and resource management practices on Department lands. Likewise, a constantly increasing amount of cooperation has been secured from users of the land and from other agencies operating in the soil conservation field.

Plans have been outlined for a more widespread and effective attack on soil erosion in anticipation that the necessary funds will be made available to the Department on a basis proportional to the funds now provided for private lands.

The Soil Conservation Program of the Department of the Interior is an important segment of the soil conservation program of the Nation. In general, departmental lands are more seriously depleted than lands in private ownership for the restoration of which vast sums are provided by Congress. For the current fiscal year of 1947 Federal funds are available for Interior lands at the rate of fifty-six hundredths of a cent per acre in contrast with approximately 22 cents per acre, or about 40 times as much, for private land. Unless funds are made available to the Department of the Interior for the performance of needed soil and moisture conservation work on a basis comparable with the funds provided for intermingled private lands, the gains made on these private lands will be largely dissipated.

The application of curative practices to lands abused for 50 years or more is a progressive, time-consuming action in which the assistance of nature is required. The variableness of climate and of growing seasons for vegetation and many other factors must be considered and planned for.

The revegetation of depleted lands, particularly those areas on the watersheds above some of the larger reclamation projects, is the most important part of the soil and moisture conservation program of the Department of the Interior. It is a difficult problem at best since, in addition to the normal difficulties involved in revegetation of any land, there is the problem of distance from sources of labor and supplies for use at the right time of the year to perform revegetation work.

There are many areas where the amount and quality of vegetation have been greatly impaired and in some instances actual destruction has occurred, so that the surface of the ground is bare. As a general rule, these areas are of considerable extent and of rough topography in addition to being com-

paratively inaccessible. Furthermore, revegetation to be successful at all must be done during the brief periods when moisture conditions are most favorable. This combination of conditions definitely precludes the use of conventional farm machinery.

Much has been learned regarding the possibilities of revegetation on a small scale and under closely controlled operations. No final answer has been devised for revegetation on the broad scale necessary on the vast areas of public lands. However, a demonstration project is being conducted in speeding up range reseeding through the use of an airplane. The demonstration involves sowing certain suitable species of grass seed on a number of areas totalling 50,000 acres on Indian reservation lands in the State of Arizona. While sufficient time has not elapsed for fully determining the efficiency and value of this method, the present indications are very encouraging.

During the 5-year period heretofore mentioned, it has been possible to perfect and put into action nearly 5,000 farm conservation plans on Indian lands, which represent the primary operations on cultivable lands. On range and other lands the work performed has consisted of the construction of large numbers of small reservoirs and stock-watering places, the building of a large mileage of control fences to protect areas that have been reseeded or which are overgrazed and need to be rehabilitated, the construction of many thousands of small check and gully control dams, the successful retment of eroding stream channels, and numerous minor but necessary companion operations.

During the fiscal year 1946, because of financial and other limitations, only about 1,200,000 acres of land were thus progressively treated. The progress made in 1946, if used as a measure in planning the correction of the adverse conditions on 60,000,000 acres of severely to critically eroded land, is not encouraging. Fifty years will be required to do a job that should be done in 10 years or less if the lands in question are to be saved for the future use of the Nation. Meanwhile, another 73,000,000 acres are deteriorating too rapidly. Every year more land enters into the critical erosion class.

Forest Management

The program of the Office of Land Utilization in the field of forest management has been directed toward adequate protection from loss by fire, insects, or diseases for all the vegetative resources on lands administered by the Department; consummation of cooperative sustained-yield agreements with owners of forest properties adjacent to or intermingled with Department of the Interior lands; and adequate technical management of forests on unreserved and unappropriated public domain lands in the continental United States and Alaska. The accomplishment of these objectives will aid greatly in placing forest management on lands under the juris-

diction of the Department on a basis of sound business practice, with due regard for technical forestry principles.

Forest protection.—When the departmental war emergency appropriation “Fire protection of forests, forest industries, and strategic facilities (national defense)” was discontinued, the Congress, at the request of the Office of Land Utilization, increased the respective Bureau appropriations, in lieu of the funds formerly provided in the emergency appropriation, in amounts sufficient to provide more nearly for adequate fire control on the forest, brush, and grass lands under their jurisdictions. Appropriations for fire control now stand at their highest level in the Department’s history. While, largely because of the rising costs of labor and equipment, these funds are not yet sufficient to provide adequate protection against fire, the several agencies concerned are much better prepared than ever before to cope with the fire problem. The fire control record of the Department during the war period, in the face of shortages of all kinds, is concrete evidence of progress in this direction. From the calendar year 1942 through the calendar year 1945 the number of fires was reduced from 3,316 to 2,435 and the Federal area burned from 1,879,613 to 844,583 acres.

At the suggestion of the Office of Land Utilization, arrangements were made between the General Land Office (now the Bureau of Land Management) and the Forest Service of the Department of Agriculture, and later approved by the Congress, whereby the General Land Office would reassume on July 1, 1945, its responsibility for the protection from fire of the forests lying on the unreserved and unappropriated public domain in the continental United States outside of the grazing districts. Since 1938, funds for fighting forest fires on these lands had been appropriated by the Congress to the Forest Service. Pursuant to the authority carried in the Interior Department Appropriation Act, 1946, the General Land Office consummated contracts with the States of California, Montana, Minnesota, Oregon, Arkansas, Washington, and Idaho, and with the Forest Service, which provided collectively for the protection of 3,981,208 acres of public domain at a cost of \$190,395.06 during the fiscal year 1946.

The Office of Land Utilization, as liaison office for the Department with the Bureau of Entomology and Plant Quarantine in the Department of Agriculture, continued its coordination of the white pine blister rust control program. This tree-disease problem involves the suppression of the disease-spreading alternate host plants (currants and gooseberries, commonly called *Ribes*) on white pine producing areas in the United States. These lands consist of approximately 28,000,000 acres, of which 715,397 acres are Interior Department lands under the jurisdiction of the National Park Service, the Office of Indian Affairs, and the Bureau of Land Management. Although the control program during the war period was largely one of holding the disease in check, considerable progress was also made towards completing the initial suppression work and required rework that would place

the program on a maintenance basis. On December 31, 1945, a total of 381,784 acres had been worked over once and a total of 201,302 acres were considered to be on a maintenance basis requiring a field investigation only every 4 or 5 years. Plans were complete at the end of the year to conclude the program for initial eradication of the Ribes within 5 years, beginning with the fiscal year 1947.

Cooperative sustained-yield agreements.—A major advancement in the sustained-yield management of the approximately 2,500,000 acres of the Oregon and California revested grant lands was the declaration on November 28, 1945, by the Secretary that their annual timber-producing capacity is 606,664,000 feet, board measure. This declaration, which was authorized by the act of August 28, 1937 (50 Stat. 874), and was supported by exhaustive field examinations, increased the potential production annually of the O. and C. lands by 106,664,000 feet. The announcement was followed by the first formal hearing on a proposed cooperative sustained-yield master unit (the Siuslaw master unit) which was held on December 3, 1945. It was open to all interested persons, including Federal, State, and local officials, and representatives of dependent industries, local residents, and labor. The recommendations received at this hearing are now undergoing the essential review prior to the formal establishment of the unit. The future program provides for similar hearings on the other 11 master units and the some 107 sustained-yield management units to be organized within the 12 master units.

Management plans.—Plans for the orderly utilization of the timber from the public domain, both in the interior of Alaska and in the continental United States, under technical forestry principles and good business methods, were advanced in a major way by the organization of a forestry division within the General Land Office on March 19, 1946. This division is now responsible for the establishment of effective procedures for the management of the forests on the public domain. At the same time the Alaskan Fire Control Service, which now includes timber sale activities on the public lands in Alaska as well as fire control under its direct supervision, was made responsible to the Forestry Division. For the first time since February 1, 1905, the way is now clear for a start to be made toward providing intensive management for the forests on the unreserved and unappropriated public domain in the continental United States and Alaska.

Timber sales.—The end of the war did not lessen the demand for timber products and there has been no decrease in the timber sale operations conducted on the lands under the jurisdiction of the Department. The heavy demand for lumber for postwar construction gives promise of continuing for some time to come. During the year the timber sale operations on Department lands constituted a business amounting to more than \$3,-621,000 in value. The total amount of timber cut during the year was slightly under 1,000,000,000 feet.

Water Resources Committee

The general objective sought by the Water Resources Committee is to insure the coordination of the water-development programs within the Department, in order that full recognition may be given to the over-all benefits to the Nation.

The staff work of the Committee, established by Departmental Order dated May 2, 1944, was conducted by the chairman and the executive officer. Twelve formal meetings were held, and in addition the executive officer represented the Committee at 12 meetings of the Federal Inter-Agency River Basin Committee, 9 meetings of the subcommittee on hydrologic data, and numerous other committee meetings having to do with intra- and inter-agency coordination and cooperation.

The interests of the various agencies of the Department with respect to numerous water-project and basin-wide reports were coordinated, and assistance was rendered in the preparation of these reports, which included project reports on Mountain Home and Lewiston Orchards, Idaho; Paonia, Colo.; and Santa Barbara County, Calif.; and departmental basin reports covering the Central Valley of California and the Colorado and Columbia Rivers.

Thirty flood control and river and harbor reports of the Corps of Engineers, War Department, covering areas lying west of the Ninety-seventh Meridian were reviewed by the Committee in accordance with the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945, and reports on these documents were made by the Secretary to the Chief of Engineers.

A meeting of the Committee and of representatives of interested agencies was held at Omaha, Nebr., on March 27, 28, and 29, 1946, at which recommendations and procedures were adopted leading to the establishment of the Departmental Missouri Basin Field Committee for the purpose of expediting and coordinating the Department's program in the Missouri River Basin. This Committee was established by Departmental Order dated May 31, 1946.

The executive officer acted as liaison with the Missouri Basin Inter-Agency Committee and with the Columbia Basin Inter-Agency Committee. Detailed information concerning water projects, laws, policies, and related features were assembled and made available to interested agencies of the Department.

The progress made in the coordination of the water development programs of the Department of the Interior has been encouraging; and procedures laid down by the Congress in the Flood Control Act of 1944 and the Rivers and Harbors Act of 1945, and carried forward in current omnibus bills, have greatly strengthened the cooperation between Federal agencies and between Federal agencies and the States. Much remains to be accomplished, however, before the degree of cooperation essential to sound management in this complicated field can be completely obtained.

Land Classification

The Office of Land Utilization continued its review of public land cases which required approval by the Secretary. Approximately 1,300 cases were examined in connection with requests for State exchanges, indemnity selections, rights-of-way, withdrawals, and reservations. In addition, upward of 200 applications for homesteads, public sales, exchanges, grazing leases or permits, or other disposal or use of the public lands, on appeal to the Secretary from adverse decisions of the General Land Office, were examined, and recommendations submitted as to the decisions that should be made. Most of these cases involved highly controversial issues concerning the suitability of the lands for particular uses or their value to particular persons.

A survey of land areas used for military purposes during the war, which might be suitable for administration by the Department if and when declared surplus by the War and Navy Departments, was made during the year in response to a request by the Bureau of the Budget. A list of 69 such areas was submitted to the Bureau of the Budget as a basis for proposed legislation authorizing the transfer of the areas to the Department of the Interior upon their being declared surplus.

Under instructions from the Secretary of the Interior, the Department has begun the compilation of a preliminary inventory of the natural resources of the United States, including the farm lands, the range lands, the forests, the minerals, the wildlife, the fisheries, the water resources, and the recreational resources. Direction of the inventory has been assigned to the Office of Land Utilization.

Civilian Public Service Camps

The Office of Land Utilization continued to represent the Department and the bureaus concerned in all matters relating to the operation of civilian public service camps on Department of the Interior lands requested by the Selective Service System.

These camps are manned by men subject to combatant training and service in the land and naval forces of the United States who by reason of religious training or belief are found to be conscientiously opposed to participation in war. By agreement between the Department and the Selective Service System, the program of work on Interior lands is confined to the protection and conservation of natural resources, including fire, insect, and disease control, and water conservation projects.

By reason of the end of the war the number of civilian public service camps operating on Department of the Interior lands was gradually reduced from 10 active camps at the beginning of the year to 3 at the close of the year—2 on national parks and 1 on a national wildlife refuge.

General Land Office

FRED W. JOHNSON, *Commissioner*¹



RECONVERSION of its World War operations to meet national demands for maximum peacetime use of the public lands and their natural resources, was the major undertaking of the General Land Office during the 1946 fiscal year. The transition from providing millions of acres of land for troop training, bombing range, tank maneuvering and other military uses to a program affording postwar opportunities for settlement on public domain areas, particularly in Alaska, was well under way at the close of the fiscal period.

Rapid progress also had been made in a similar rechanneling of the millions of tons of minerals, millions of gallons of petroleum products, and millions of board feet of timber and other forest products from military purposes to meet the requirements of a stabilized postwar industrial economy. At the same time satisfactory progress was made in formulating plans to clear away the accumulation of land administration problems which for the past 5 years have been dammed up behind exigencies of the military program. More than 100,000 cases involving land administration problems of essential, though not of such urgent importance as to demand immediate attention in the midst of the military program, were conservatively estimated to form part of the year's work, while a backlog of responsibility involving the survey or resurvey of more than 100,000,000 acres of public land—projects already authorized but laid aside for immediate war-connected survey tasks—remained on the General Land Office books.

Reorganization

Definite steps toward streamlining the work of the General Land Office to meet the new and increasing responsibilities of the post-war era were taken near the close of the fiscal year. In May 1946, President Truman submitted to Congress Reorganization Plan No. 3, which provided for a consolidation of the General Land Office and the Grazing Service in the Department of the Interior into a new Bureau of Land Management.

¹ On July 16, 1946, the General Land Office was consolidated with the Grazing Service to become the Bureau of Land Management in the Department of the Interior. Mr. Johnson was named Acting Director of the new Bureau.

Details of the rearrangement of the General Land Office structure and procedures were brought close to completion by the end of the fiscal year, thus paving the way for early effectiveness of the President's program to remove unnecessary duplication in land administration activities and insure maximum efficiency in transaction of the Government's business in the public interest.

Meantime, the establishment of the Bureau of Land Management marked the termination as a separate identity of one of the oldest agencies in the Federal Government. It also opened a new chapter in the history of public land administration in the United States which had its inception with the beginning of the Republic itself and in all of which, with the exception of its earliest beginning, the General Land Office, first established as a Bureau in the Treasury Department in 1812, had played a direct part.

Chronologically, Federal land administration began with the Ordinance of 1785, largely sponsored by George Washington and Thomas Jefferson, under which the Continental Congress directed that identification of land in the new Republic should be undertaken on the standardized pattern of townships 6 miles square. Thereafter disposal of the public lands in accordance with the survey system was carried out by the Treasury.

In 1812 the General Land Office was set up as a Bureau in the Treasury Department for the handling of administrative matters involving the public domain, and when the Interior Department was established in 1849, the General Land Office was transferred to that Department. Throughout the 97 years which followed, the Office, serving in its capacity as official real estate agent of the Government, played a striking role in the advancement of American civilization westward to the Pacific. Making Government land available for settlers, for the construction of transcontinental railroads, mineral development, and other activities, the volume and rapidity of Office operations at one time led to the coining of the popular phrase, "doing a land office business."

Meantime, the Congress carried forward a systematic enactment of new laws affecting the administration of the Federal public domain until today the body of public land law is made up of more than 5,000 statutes which serve as the basis for adjudicative and administrative procedures.

The wide scope of problems and responsibilities confronting the General Land Office in its administration of the Federal public lands is shown by excerpts from the first and the last annual reports made by the Commissioner of the General Land Office to the Secretary of the Interior. For example, J. Butterworth, Commissioner, in the first annual report to Secretary of the Interior Thomas Ewing, pointed out that: "The successful application of steam to the purposes of navigation, the result of American genius, has produced a new era in the world. It required only proper encouragement to develop the boundless resources of our country in mind and matter and to lead to results equally important in every department of science." At an-

other point the first Commissioner refers to survey work in Wisconsin, Iowa, and some of the Northern States, and declares that "These lands are difficult of access and for the greater part of each year are shut in by impassible barriers of ice and snow." All these in sharp contrast to items in this, the ninety-seventh annual report, which call attention to the potential increased use of the public lands in connection with international air lines and the advancement of plans for the broad economic development of Alaska.

Development of Alaska

More than 90 percent of the Territory of Alaska consists of vacant public land whose disposal or the development of its natural resources under the public land laws is a direct responsibility of the General Land Office. Consequently, plans for the future maximum beneficial use of the public domain areas in Alaska formed an important part of the work program of the Office during the 1946 fiscal year.

Stimulated by a public interest in the Territory greater than ever before in recent years, demands for information concerning living conditions and opportunities in Alaska at times literally swamped the facilities of the Office directly engaged in public land administration in the Territory. Thousands of ex-service personnel and other potential travelers over the newly completed Alaska Highway, were furnished with informational material prepared by the General Land Office during the year.

At the same time, definite steps were taken to promote economic development and wider utilization of public domain areas in the Territory. Special field parties of land experts were sent to Alaska during the year to ascertain and evaluate the possibilities for increased agricultural settlement in the Territory and other measures, looking to maximum land use, were set under way.

Early in the administration of the public land in the Territory under national conservation policies, it was deemed advisable to reserve large areas of shore space from general use in order to provide access to the interior of Alaska. Having served this initial purpose, it was determined during the fiscal year that current Territorial development requirements warranted the abrogation of some of this shore space reserve; a special examination to ascertain which portions of the areas may now be made available for settlement or other use under the public land laws was begun by the General Land Office during the year.

Construction of the Alaska Highway, affording an overland route from the United States into the Territory, was an outstanding achievement in connection with the prosecution of World War II. When construction of the highway was begun, a strip of land 10 miles wide on each side of the road's proposed route was withdrawn from general public use, thus removing approximately 8,300,000 acres of public domain which otherwise

would have been susceptible of utilization in the development of the mineral and other natural resources in the Territory. The withdrawals were made with the intention on the part of the Department of the Interior that the areas would be restored to general public use as soon as the need for their use under the military program has ceased. Accordingly, arrangements had been brought near completion at the end of the fiscal year for a reduction in the size of the withdrawals and the retention of merely a small right-of-way strip along the highway thus restoring large areas of the Federal domain to public use.

Similar action was taken shortly after the close of the fiscal year in connection with more than 18,600,000 acres located on the Alaska and Kenai Peninsulas originally set aside for the development of possible petroleum supplies for the armed forces in the Territory during the war.

Revenues

For many years the General Land Office has been one of the few agencies of the Federal Government whose operations have resulted in revenues in excess of the cost of administration. In the 1946 fiscal year total receipts from its activities amounted to \$13,104,067, and expenditures out of appropriations of only \$2,822,662. This surplus of receipts over expenditures represents a ratio of \$4.64 in revenue for every \$1 spent on the operation of the Office.

Review of the Year's Work

Detailed accomplishments during the 1946 fiscal year by the various elements in the General Land Office structure may be briefly outlined as follows:

The need for use of the Federal public domain as a source of materials with which to win the war, in some instances, resulted in a relaxation of conservation safeguards against a too rapid depletion of the Nation's supply of natural resources; the cessation of hostilities afforded opportunity for the restoration of these safeguards which found its reflection in the volume of work confronting the General Land Office during the year. Based on current demands for the protection of the public lands to insure their maximum beneficial use in the postwar economic period, the divisions in the Office primarily charged with the scientific solution of land administration problems were called upon to make definite contributions in research, analysis and land classification operations.

Postwar requirements for an increased supply of timber from the Federal lands was an outstanding problem which engaged the attention of the Research and Analysis Division during the fiscal period. Detailed plans were formulated for the inauguration of the sustained yield program of forest management on public lands of the United States, under which a safe balance between the volume of tree cutting and of tree growing is maintained to insure a perpetual supply of raw material.

At the same time a broad streamlining of administrative processes in Alaska which would permit a wider degree of utilization of timber products on the public lands in the Territory was begun.

One of the present handicaps to complete success in the administration of Federal real estate is the lack of a consolidated record of property owned by the Federal Government. With legislation pending in Congress for the ultimate establishment of such a central inventory, the General Land Office and its divisions were called upon during the year to conduct preliminary studies as to the best methods for putting such a system into operation. At the same time expert assistance was rendered the Territorial Government of Alaska in the preparation of plans for the recordation of real estate titles in the Territory.

Meantime, progress was made during the year in the compilation of inventories and other records to facilitate the administration of the public lands. County maps and tabulations showing the pattern and land ownership status as of 1940 of the remaining public domain lands are now available for the following States: California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming, and other records were augmented during the year as a result of the Divisions' work.

One of the major requirements in the disposal of the Federal public lands today is that the area sought must be suitable for the use to which it is intended to be put. Thus, the land must be classified before an application for its acquisition can be approved. This classification is the primary responsibility of the General Land Office involving a heavy volume of work during the fiscal year. Not only was considerable work undertaken in Alaska, where heavy demand for land settlement opportunities made necessary the delineation of areas suitable for agricultural expansion, but a comprehensive program of land classification work in the United States was carried forward during 1946. Particularly, the demand for lands under the Federal law which permits the leasing of small areas for home, cabin, camp, health, convalescent, recreational and business sites, commanded much attention from the scientific classification branches in the Office. Although California and Arizona continue to be the focal points in the demand for these sites, considerable interest was shown in areas in Nevada, New Mexico, and Florida during the year. In the aggregate, preliminary work leading to the classification of over 75,000 additional acres which might be found suitable for small tract use was accomplished during the year and the area classification work provided the basis for approximately 10,000 leases applied for by veterans and others during the year.

In addition, land classification work was started during the year in the Missouri River Basin. Under this program physical and economical data relating to the classification, development and management of public lands will lay the foundation for land development and management activities in the basin.

Protection of millions of acres of Federal public land against damage by fire was one of the new responsibilities placed upon the General Land Office during the 1946 fiscal year by direct mandate of Congress. As a consequence plans were made and negotiations set under way looking to the protection of these lands through contracts with Federal and State agencies. In the aggregate 4,000,000 acres of public land were protected through fire contracts costing approximately \$198,000.

New problems of postwar land administration, the solution of knotty legal problems arising from the accumulation of war-postponed cases and the preparation of policies and regulations essential to the operation of new Federal land statutes, placed an unprecedented volume of work upon the Law Division of the General Land Office during the 1946 fiscal year. In addition to the task of reviewing more than 27,000 items of legal importance during the year, the Division was instrumental in the collection of more than \$50,000 through the enforcement of laws against trespass on the public lands and other claims for amounts due the United States. Legal experts of the Division were called upon to assist in the negotiations relating to the consolidation of the General Land Office with the Grazing Service into the Bureau of Land Management of the Department of the Interior, and much legal assistance was rendered in the handling of surplus property whose disposal was undertaken by the Office as part of the Nation-wide war assets liquidation program.

Among the proposals for Federal legislation prepared in the Division during the year was a bill designed to give full effect to the proclamation by the President that all the natural resources of the subsoil and seabed of the Continental Shelf, off the shores of the United States, were the property of the Federal Government.

Rules and regulations reserving to the United States complete control and ownership in uranium, thorium and other fissionable materials essential to the development of atomic energy also were prepared by the Division during the 1946 fiscal year.

The General Land Office maintains about 4,000 tract books on which notations are made of all transactions affecting the public lands. These volumes are designed to show at all times the status of each smallest legal division of the public lands. More than 100,000 notations were made on these records during the fiscal year.

The adjudication of applications and claims for tracts of the public land of the United States is a responsibility resting upon the General Land Office which is equally as important as the necessity for adequate scientific planning and sound legal interpretation in the administration of the broad expansion of public domain in the postwar period. This highly essential, though unspectacular work, is performed by the several adjudicating divisions in the Office whose operations produce the major part of the revenue collected during the year as a result of its activities.

Outstanding among the year's work was the handling of thousands of cases involving the development of oil and gas and other mineral resources on the public lands. Shortly after the close of the fiscal year 1946, the Congress enacted amendments to the Mineral Leasing Act of 1920 providing for a reduction in the royalties to be paid the Government and other features calculated to result in increased opportunities for exploration, discovery and development of any supplies of these products for use in the postwar period.

Another division in the General Land Office handled more than 2 dozen types of land administration cases, among them being the processing of applications for homesteads on Federal reclamation projects and the final closing out of the historic railroad land grants under which in earlier periods of American history Federal land was granted for the construction of transcontinental railroads. One section of the Transportation Act of 1940 provided for the termination of this type of Federal land grant and legislation was before Congress at the end of the fiscal year to provide a policy for the administration of all the land, claims to which were relinquished by the railroads.

What to do with land purchased or otherwise acquired during the war and added to military reservations of the United States is a problem which confronted Congress and the General Land Office in the 1946 fiscal year. With the enactment of the necessary statutes much of the surplus land in present military reservations might be made available for settlement or natural resource development, and another division in the Office prepared in 1946 to give full effectiveness to any legislation which subsequently may be enacted.

The lease of public land areas for use as hangar sites and other operations incident to the maintenance of public airports is another problem confronting the General Land Office in the postwar period which awaits congressional action.

The leasing of land for the grazing of livestock on areas of the Federal public domain so small, scattered or isolated as to prevent their inclusion within an established Federal grazing district formed another one of the land administration responsibilities of the Office during the past year. Under these operations more than 11,600,000 acres of the Federal domain were made available for grazing through the issuance of approximately 10,000 leases with a total revenue return to the Federal Government of \$235,534 in rental.

A broad program of range development and improvements in connection with the use of these leased areas was included in the operations of the General Land Office in 1946, made possible through the allocation under the Taylor Grazing Act of a portion of the proceeds from the lease of the public lands. A comprehensive schedule of construction work including the building of dams, reservoirs and watering places, as well as the erection

of fences and corrals, was prepared for completion as rapidly as shortages in materials and labor will permit.

Surveying the Public Lands

Because no tract of land properly may be set aside for any use until its location and boundaries have been accurately determined and permanently recorded, the Government's cadastral surveys have been the basic foundation in negotiations for the disposal, exchange, withdrawal or other change in the status of the public domain areas since 1786.

Differing from the type of survey work which involves primarily the recording of geographic or historical features of the terrain, cadastral surveying consists of careful measurement of the areas of land on the ground, the recording of such measurements by the placing of monuments or other markers, and the preparation of maps scientifically compiled from notes made by trained engineers at the time of the on-the-ground measurements. First undertaken by the General Land Office when the system of public land surveys decreed by the Continental Congress was transferred to its jurisdiction in 1812, maintenance of a Cadastral Engineering Service has been a continuing responsibility of this office.

During the 1946 fiscal year cadastral activities were carried on in 22 States and the Territory of Alaska, under 62 separate groups. A total of 7,950 miles was surveyed or resurveyed, embracing 1,125,557 acres. Among the outstanding accomplishments of the year was a completion of surveys in areas in the vicinity of Twenty-nine Palms, Calif., by which land was made available for use by thousands of applicants seeking portions of the public domain under the small tract leasing act. Another unusual survey involved the determination of the geographic position of initial points of four principal meridians in the States of Alabama, Arkansas, Florida, and Louisiana. Survey work in connection with the development of the Missouri River Basin also formed an outstanding part of the year's work performed by the Cadastral Engineering Service.

Meantime, better administrative procedure was made possible during the year by a reorganization of the Service and regrouping of its district organization. Under the reorganization district No. 1, which originally included Colorado, Wyoming, South Dakota, and Nebraska, was enlarged to include the States of Montana, North Dakota, Kansas, Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio. The headquarters of this district are maintained in Denver. District No. 2 was expanded to include the States of New Mexico, Arizona, southern California, Oklahoma, Arkansas, Louisiana, Mississippi, Alabama, and Florida, with headquarters at Santa Fe. Idaho was added to Utah and Nevada to comprise district No. 3, with headquarters retained at Salt Lake City. Oregon, Washington, and northern California were regrouped into the fourth district, with headquarters at Portland, Oreg.; and district No. 5, embracing the Territory of Alaska, remained unchanged with headquarters at Juneau.

District Land Offices

A record of nearly 150 years of uninterrupted service to the public in the administration of the Federal domain was established during the 1946 fiscal year by the network of district land offices maintained under the supervision of the General Land Office. Serving as the first point of contact with the thousands of settlers, who, through past generations sought new hearths and homes on the public lands, original "over the counter" transactions in these offices, in many instances, marked the beginning of many of the land administration problems which accompanied the development of the Republic westward to the Pacific.

With the establishment of the first district land office in Ohio in 1800, these outposts of land management spread throughout the West and reached a total of 393 offices at the height of the national public land disposal program. Whenever most of the Federal domain within a land district virtually had passed from the Government into private hands, the offices were closed and the land records transferred to the State authorities.

Today there are 25 district land offices located in 13 Western States and the Territory of Alaska in which applications for use of the Federal land and its resources may be filed and other negotiations in connection with the public domain may be carried on in direct "over the counter" proceedings based upon more than a century of experience in these transactions. The location of the district land offices is as follows:

Alaska:	Nevada: Carson City.
Anchorage.	New Mexico:
Fairbanks.	Las Cruces.
Nome.	Santa Fe.
Arizona: Phoenix.	North Dakota: Bismarck.
California:	Oregon:
Los Angeles.	Lakeview.
Sacramento.	Roseburg.
Colorado:	The Dalles.
Denver.	South Dakota: Pierre.
Pueblo.	Utah: Salt Lake City.
Idaho:	Washington: Spokane.
Blackfoot.	Wyoming:
Coeur d'Alene.	Buffalo.
Montana:	Cheyenne.
Billings.	Evanston.
Great Falls.	

Negotiations relating to public lands in States in which no district land offices are maintained are handled through the Washington headquarters.

Branch of Field Examination

Proper observance of the public land laws is an element of administration equally as important as that of land identification by the General Land Office. The enforcement of the laws and the prevention of trespass and

other depredations on the public domain are the primary responsibilities of the Branch of Field Examination which, during the 1946 fiscal year, carried out investigations in 27 States and the Territory of Alaska.

Geographically grouped so as to afford speedy action upon the varied problems confronting the service, the Branch of Field Examination forces include civil, mining, and metallurgical engineers, geologists, lawyers, auditors, timber and range specialists, and others experienced in land law and procedure. Regional offices are located at San Francisco, Calif.; Billings, Mont.; Salt Lake City, Utah; Albuquerque, N. Mex.; Anchorage, Alaska, and Washington, D. C.

Under national conservation provisions of the Federal statutes public lands today must be designated as suitable for disposition in accordance with the particular law under which an application is filed before favorable action can be taken. The making of field investigations to determine the availability of the land and its resources formed a major factor in the work of the Branch during the year. The data gathered in these investigations furnished the basis for decisions as to allowance or rejection of the homestead, desert, private or public exchange, timber, and stone or other application. Tracts of land embraced in public sale, exchange and other applications were appraised on the ground.

Land use studies of areas to determine whether they should be set aside for disposition or lease under the small tract law, devoted to recreational purposes for general public use, or turned over to the other State or Federal agencies to insure better utilization, also formed part of the Branch work program in 1946.

Considerable work was performed in connection with the appraisal, sale and disposal of improvements and properties used during the war, which were later declared surplus and turned over to the General Land Office for disposition.

In Alaska, all surplus real property is disposed of by the General Land Office, and during the past year appraisals have been made at several Alaskan points, chief among which were the Chilkoot Barracks, Fort Raymond, and the Seward Harbor Defense Area. In the United States the Branch of Field Examination made appraisals of various properties declared surplus prior to their disposal, one of which was Heart Mountain Relocation Center, in Wyoming, which, incidentally, while in use, was the third largest town in the State. Other areas which were appraised preliminary to sale, are the Manzanar and the Tule Lake Relocation Centers in California, the Umatilla depot project in Oregon, the Willapa Bay Military Reservation in Washington, the Minidoka Relocation Center in Idaho and the Gila River and Colorado River Relocation Centers in Arizona.

The examination and appraisal of patented and unpatented mining claims, preliminary to clearing title to the lands within military and other projects, was carried forward in 1946, and progress was made on the elimi-

nation of invalid claims and on the appraisal of valid claims and patented lands preliminary to their acquisition by purchase or condemnation.

The work of the year also involved investigations in connection with the use of public land areas in the development of the Missouri River Basin and other projects under the national reclamation development program. In addition, investigation of more than 93,000 acres of land in Montana and Wyoming, was made to determine its possibility for grazing use in areas hitherto withdrawn for reclamation construction purposes.

The original field service unit of the General Land Office was organized to combat the unlawful cutting of timber on public land, and was named the "Timber Trespass" division. The investigation of trespasses is still an important function and is currently handled by the Branch of Field Examination. Such trespasses involve timber cutting, illegal mining of coal, removal of gravel and other resources, and illegal occupation of public lands. Complaints are investigated and the evidence collected is used as a basis for civil proceedings, where necessary, to collect damages, and in aggravated cases, results in criminal prosecution. Examiners also frequently assist the United States Attorney, at his request, in the preparation and trial of these cases.

In the past fiscal year, settlement has been made in 348 trespass cases which resulted in the recovery of a grand total of \$44,081.

An important feature of the conservation of natural resources is the protection of valuable timber stands on the public domain, particularly since the demand for lumber during the war unfortunately denuded considerable land chiefly valuable for timber culture. Supervised sales of timber on public lands have not departed from recognized principles of conservation and a large number of sales of mature timber, including insect-infested and dead and down timber, have been made, following a check in the field by examiners qualified as logging engineers.

The regional office at Anchorage, Alaska, rendered its first year of service in 1946, and the results reflected numerous benefits to all concerned. The problems arising in the Territory differ only as climatic conditions and applicable laws differ. Much land is available there which can be adapted to agricultural purposes. Trade and manufacturing sites, fur farms, grazing leases, and other forms of entry afford many opportunities to the pioneering settler. Recreational advantages are of interest both to residents and those from "stateside." During 1946, the office personnel devoted much time to furnishing assistance and information to the residents, and others interested in Alaska's vast resources, and results have fully justified the establishment of a regional office there. It is anticipated that improved travel and communication facilities will result in expediting the handling of public land matters between Territorial residents and the General Land Office.

Sustained Yield Forestry

After nearly a decade of successful operation, marked advancement toward the goal of a perpetual supply of timber and other forest products for America's economic well-being was recorded in the Pacific Northwest during the 1946 fiscal year through the operations of the Oregon and California Revested Lands Administration of the General Land Office. Developments during the year included the holding of public hearings for the establishment of a greater degree of cooperation in the handling of the natural resources so vitally essential in the postwar period. At the same time, mutual negotiations between the Federal and State Governments and private citizens resulted in the furnishing of more than 345,000,000 board feet of timber, most of which went to meet the Nation's construction demands, with a resultant revenue of more than \$1,420,000 from the sales of these resources in the area.

"How long will my job last? Will my children's future welfare be assured by the timber supply in our vicinity? Can the prosperity of our community be maintained for an indefinite length of time?" These three questions long have mirrored the fears of the forest products industry throughout the world. At some stages in American history an irrevocable negative answer produced bare areas denuded of trees, "ghost" towns, and the resultant wreckage of local economic units which the Nation could ill afford to bear.

Government and industry alike have recognized that sustained yield operations—the maintenance of a reasonable balance between the volume of tree cutting and tree growing—hold the only satisfactory answer to the problem. Each has striven to put such a program into actual practice in its own field of endeavor and in so doing has pointed the way to greater cooperation between the two for the benefit of all. The extent to which this cooperation can be made to work for the stabilization of the industry and its dependent communities has nowhere been so strikingly demonstrated as in western Oregon where Federal lands, privately owned, State and county-owned lands are intermingled to form what is in effect the world's largest experimental laboratory in practical forest management. The administration of these "O. and C." lands by the General Land Office formed the outstanding feature of the Nation-wide program of conservation of natural resources of the Department of the Interior during the fiscal year.

Presenting one of the most complex problems in forest management in the entire field of forestry, the area, 300 miles long and 60 miles wide, extending through 18 western Oregon counties from the Columbia River to the California State line, includes more than 8,000,000 acres of forest lands located in the very heart of the famous Oregon Douglas fir belt. With ownership of the lands scattered through eight different types of holdings, of which private and county owned lands combined comprise 52 percent of the total, the 2½ million acres of public land under the jurisdiction of the

General Land Office constitute the foundation upon which the far-seeing program for mutual cooperation in sustained yield forest management activities is based.

Incidentally, the history of these "O. and C." lands is of itself an interesting chapter in the economic advancement of the Pacific Northwest. Prior to 1866, practically all of these lands were public domain but in July of that year a grant was made to the Oregon and California Railroad Co. to aid in building a railroad from Portland, Oreg., to the California State line in connection with the Central Pacific Railroad. Subsequently the grantees failed to live up to the provisions of the grant and the lands ultimately were ordered revested in Federal Government ownership. In 1937, Congress enacted a law providing for the installation of a sustained yield forest management plan in the area. The Oregon and California Revested Lands Administration was established in Portland, Oreg., by the General Land Office to administer this law.

While progress on the administrative features of the program was retarded during the war years, timber from the "O. and C." areas formed an important element in the supply of forest products essential to the conduct of military activities.

With the cessation of active hostilities opportunity was afforded to carry forward the program of cooperation between the Government and its citizens in negotiations which formed the highlight of activities during the 1946 fiscal year. As a consequence hearings were held at Eugene, Oreg., in December 1945 on plans for establishment of the first of 12 proposed master economic units in which sustained yield timber cutting and appurtenant marketing operations would be carried on for the benefit of the industry and communities directly concerned.

In addition to the administration of the balanced tree cutting program, other factors in beneficial land use under national conservation were included in the record of accomplishments for 1946. Among these were a study of damage done by deer to tree plantations in the area, and experiments in the seeding of burned forest tracts by airplane.

Beneficial use of the land in the revested "O. and C." areas, other than for sustained yield timber cutting operations, was provided in 1946 under the work program of the administration. For example, more than 230 leases for the grazing of livestock on the lands were issued during the year. Altogether almost 350,000 acres thus were made available for the grazing of more than 28,000 animals on areas where such use would not interfere with forest production. The program also involved the setting aside of appropriate tracts in the area for recreational purposes.

Alaskan Fire Control Service

Maximum beneficial use of the supply of forest products on the public lands in Alaska is a problem of outstanding importance in the economic

development of the Territory. The responsibility for timber management and prevention and suppression of forest fires on the public domain areas are tasks handled by the Alaskan Fire Control Service of the General Land Office. During the past fiscal year the Service was charged with the responsibility for fire protection on more than 225,000,000 acres of forest, brushland or other vegetated areas.

Of the 124,431 acres depleted by fire during the 1946 fiscal year, 38 percent was caused by lightning, 18 percent by smokers, 30 percent by debris burners and campers, and the remainder by other miscellaneous causes.

In addition to its educational campaign for the prevention of fires in Alaska and the suppression of such conflagrations as its limited personnel and fire-fighting facilities will permit, the Service was made responsible for the handling of timber sales from public lands in the Territory.

This responsibility, transferred from the Branch of Field Examination under a program which recognizes the relativity of management as part of the general timber administration program in Alaska, is expected to form a major factor in the work program during the coming year.

Surplus Real Property

One of the responsibilities placed upon the General Land Office in 1946, following the termination of the war, was that of the disposal of grazing and mineral lands and certain other types of real property declared to be surplus upon the expiration of its value for military use. Up to June 30, 1946, 20 declarations of surplus property for handling by the appropriate division in the office involved properties in continental United States, valued at \$53,606,815, while 12 declaration in Alaska had a total value of \$23,770,058, the total of all such property placed with the office for disposal during the fiscal year being \$77,376,873.

Military use of the lands in the United States during the war period included reallocation of areas for three air fields, seven Japanese relocation centers, three recreational areas, one prisoner-of-war camp, a bombing target, arsenal plant, sawmill, and ordnance depot. All of the areas in Alaska were set aside for army installations. At the end of the fiscal year disposals by sale and transfer had been consummated in the amount of \$238,419, all involving property within the United States.

The Public Lands

Area of the public lands.—The area of public lands remaining in Federal ownership, including Indian trust and tribal lands, as of June 30, 1946, amounted to about 413 million acres in the public land States and about 365 million acres in Alaska. Approximately 419 million acres of these public lands were vacant, unappropriated, and unreserved as follows: 37 million

acres in the States outside of Federal grazing districts; 132 million acres within such districts; and 250 million acres in Alaska. During the year 501,000 acres were withdrawn for various public purposes while withdrawals reserving 167,000 acres were revoked.

Of approximately 778 million acres remaining in Federal ownership in the State and Alaska, 117 million acres in the States and 363 million acres in Alaska were still unsurveyed as of June 30, 1946.

The total acreage patented with minerals reserved to the United States was increased during the year to 48,863,127 acres as shown in the following table:

TABLE 1.—*Acreage of lands patented with minerals reserved to the United States as of June 30, 1946*

Type of mineral reservation	Patented during fiscal year 1946	Total patented through June 1946
Reservation of all minerals:	<i>Acres</i>	<i>Acres</i>
Under Stock Raising Act.....	10, 774	33, 596, 826
Under other acts.....	76, 904	2, 453, 160
Total all minerals.....	87, 678	36, 049, 986
Reservation of specific minerals:		
Coal.....	2, 437	10, 878, 052
Others ¹	6, 387	1, 935, 089
Total specific minerals.....	8, 824	12, 813, 141
Grand total.....	96, 502	48, 863, 127

¹ Includes coal reserved in combination with other minerals.

Leases and permits.—During the year an additional area of 1,960,543 acres was brought under lease, including mineral permits and licenses, making a total of 19,667,983 acres under lease at the end of the year. The types of leases in force June 30, 1946, are shown by the following tables.

TABLE 2.—*Mineral leases, permits, and licenses outstanding,¹ as of June 30, 1946*

Mineral	Leases		Permits		Licenses		Total	
	Num-ber	Acres	Num-ber	Acres	Num-ber	Acres	Num-ber	Acres
Oil and gas.....	² 8, 750	6, 034, 396					8, 750	6, 034, 396
Coal.....	337	80, 080	79	78, 483	73	2, 894	489	161, 457
Sodium.....	3	1, 239	25	35, 269			28	36, 508
Phosphate.....	9	5, 031					9	5, 031
Potash.....	20	47, 292	7	17, 781			27	65, 073
Silica sands.....	2	400					2	400
Total.....	9, 121	6, 168, 438	111	131, 533	73	2, 894	9, 305	6, 302, 865

¹ Does not include permits granted to Federal War agencies.

² Does not include 21 leases (9,566 acres) within naval reserves.

TABLE 3.—*Leases other than mineral leases outstanding, as of June 30, 1946*

Type of lease	Number	Acres	Annual rental
Aviation.....	43	28,776.27	\$525.00
Fur farm (Alaska).....	19	133,810.00	775.00
Grazing (Alaska).....	9	1,168,953.93	1,269.35
Grazing (Oregon and California).....	237	342,910.12	9,814.94
Grazing (Taylor Act, sec. 15).....	10,027	11,660,240.22	235,534.48
Recreational.....	17	20,003.78	¹ 610.70
Small tract.....	1,952	9,671.04	² 9,673.59
Water well.....	15	600.00	585.50
Others.....	3	153.01	10.00
Total.....	12,322	13,365,118.37	258,798.56

¹ Does not include rental of 1 lease, the rental of which is based on receipts.² Does not include rental of business site leases, the rentals of which are based on receipts.

In addition, 393,000 acres were being used at the end of the year by Federal and local agencies, private individuals, and corporations under permit from the Commissioner of the General Land Office. War agencies held departmental permits for the use of almost 23,000,000 acres of public lands.

TABLE 4.—*Entries and selections, fiscal year 1946*

Type of entry or selection	Original entries and selections ¹		Final entries ¹		Patents and certifications ¹	
	Number	Acres	Number	Acres	Number	Acres
Homestead entries:						
Stock raising.....	2	1,276.88	9	4,925.20	21	10,773.98
Enlarged.....	5	992.86	4	843.74	8	1,827.69
Reclamation.....	8	929.78	² 180	22,699.43	125	14,095.60
Forest.....	6	571.53	2	320.00		
Commuted.....			³ 4	240.12	3	280.12
Sec. 2289 R. S., et al.....	⁴ 123	14,489.29	⁵ 55	4,477.37	50	4,317.88
Total homestead entries.....	144	18,260.34	254	33,505.86	207	31,295.27
Other entries and selections:						
Desert land entries.....	4	427.65	10	1,304.52	12	1,855.49
Public auction sales.....			104	10,146.73	133	10,725.13
Timber and stone entries.....	1	40.00	1	40.00	77	6,837.35
Mineral entries.....	60	6,976.94	59	7,712.13	249	560.60
Indian selections.....			1	40.00	232	10,022.22
Miscellaneous cash sale entries.....	6	(⁶)	⁷ 274	8,653.13	73	85,553.64
Exchanges.....					5	⁸ 2,172.09
State selections.....	7	1,731.36				
Curative and supplemental patents.....					174	(⁹)
Others.....	(¹⁰)	20.00	3	82.05	80	5,050.75
Total other entries and selections.....	78	9,195.95	452	27,978.56	1,035	122,777.27
Grand total.....	222	27,456.29	706	61,484.42	1,242	154,072.54

¹ An original entry or selection is one made in pursuance of an act of the Congress which prescribes the terms and conditions under which patent may be issued or other evidence of title granted. An original entry becomes a final entry upon compliance by the entryman with further requirements of the law, such as residence or additional payment, and upon the issuance of a final certificate. A final certificate shows that, in the absence of irregularity, the entryman is entitled to a patent and passes equitable title to the land to the entryman. Where upon final examination it is found that an entry or selection is in proper form and that the law has been complied with, a patent conveying legal title to the claimant is issued. In the case of certain State selections, the legal title is conveyed upon approval thereof by the Secretary of the Interior and upon certification by the Commissioner of the General Land Office.

² Includes 22 homesteads on ceded Indian lands (2,511.71 acres).³ Includes 3 homesteads on ceded Indian lands (200.00 acres).⁴ Includes 1 homestead on ceded Indian lands (39.81 acres).⁵ Includes 19 homesteads on ceded Indian lands (1,386.34 acres).⁶ Town lots upon which only part payment was made (area not tabulated).⁷ Includes 76 ceded Indian town lots (area not tabulated).⁸ Includes certifications, 1,332.09 acres.⁹ Acreage previously reported.¹⁰ 1 selection was amended.

Homesteads, sales, and othe rentries.—The preceding table shows the new entries and selections allowed, the entries finally approved and the patents and certifications issued during the year. At the end of the year, 3,968 entries embracing 587,000 acres were pending awaiting further compliance with the public land laws by entrymen or final action by the General Land Office.

Land grants.—Title to 7,106 acres was conveyed during the year in satisfaction of grants of public lands made by the Congress to States and railroads for public purposes. Grants to States included 1,332 acres of indemnity school land selections, 760 acres of swamp land, and 80 acres selected for a State university. A total of 4,934 acres was patented to railroad companies pursuant to the Transportation Act of 1940.

A total of 182 applications for rights-of-way were approved during the year under laws which provide for the granting of rights-of-way over the public lands for telephone and telegraph lines, public roads, pipelines, and other purposes. Of the applications approved, 55 were permits or easements with an annual rental of \$1,220 and 26 were temporary rights-of-way over "O. and C." lands with an annual rental of \$485.

Land exchanges.—Exchanges of land with private owners and local governments resulted in the addition of 52,532 acres to grazing districts in exchange for 53,174 acres of Federal land; 5,224 acres to Indian reservations in exchange for 5,274 acres; 2,770 acres to the "O. and C." lands in exchange for 747 acres; 80 acres to a national monument in exchange for an equal acreage; and 110,086 acres to national forests in exchange for 26,278 acres of land and sufficient timber to equalize the values involved.

Receipts and expenditures.—Receipts from all sources during the year totaled \$13,104,067.13. Mineral rentals, royalties, and bonuses accounted for 85 percent of the total receipts and sales of timber from the Oregon and California and Coos Bay lands for an additional 11 percent. The remaining 4 percent were realized from sales of public and ceded Indian lands, rentals, fines and penalties, copying fees, and from miscellaneous sources.

Of the total receipts, 37 percent will be distributed among various State and county governments and 45 percent will be covered into the reclamation fund. The remainder, except for \$14,425.85 which will be credited to Indian trust funds and \$56,926.34 will be credited to the range improvement fund, will be covered into the general fund of the Treasury.

Expenditures from appropriations amounted to \$2,822,662, distributed as follows: general administration, \$937,002; surveys, \$515,332; field examination, \$371,653; fire protection and timber management, \$350,395; administration of the revested and reconveyed grant lands, \$321,021; district land offices, \$279,883; and range improvements, \$47,376. Expenditures, aggregating \$771,336, were made from funds transferred to the General Land Office as follows: for disposal of surplus real property, \$504,985; Missouri River Basin project, \$99,067; soil and moisture conser-

vation operations, \$91,161; white pine blister rust control, \$60,543; Civilian Public Service program, \$10,309; and Naval ordnance test station, \$5,271.

The following table shows the receipts earned during the year, by sources and Treasury accounts.

TABLE 6.—*Disposition of receipts of the General Land Office,¹ fiscal year 1946*

Source of receipts	Covered into the Treasury earmarked for—				
	General fund	Reclamation fund	States and counties	Indian trust funds	Total
Sales of public lands.....	\$43,492.42	² \$80,000.00	² \$3,000.00	-----	\$126,492.42
Fees and commissions.....	18,375.62	² 60,000.00	-----	-----	78,375.62
Mineral leases and permits:					
Mineral Leasing Act.....	1,003,259.76	5,266,326.23	3,761,661.60	-----	10,031,247.59
Red River oil and gas lands.....	-----	-----	2,815.29	\$4,692.16	7,507.45
Potash.....	73,968.75	³ 471,042.83	296,114.05	-----	846,120.63
Other.....	⁴ 234,810.53	-----	-----	-----	234,810.53
Total mineral.....	1,316,534.04	5,737,369.06	4,060,590.94	4,692.16	11,119,186.20
Oregon and California grant lands.....	667,111.75	-----	667,111.76	-----	1,334,223.51
Coos Bay grant lands.....	91,780.10	-----	⁵ 15,000.00	-----	106,780.10
Taylor Act grazing leases.....	56,032.11	⁶ 56,926.34	112,958.46	1,788.49	227,705.40
Right-of-way leases.....	26,162.33	⁶ 1,638.36	-----	-----	27,800.69
Sales of reclamation town lots.....	-----	⁶ 4,900.83	-----	-----	4,900.83
Sales of Indian lands.....	-----	-----	-----	7,945.20	7,945.20
Copying fees.....	21,416.98	-----	-----	-----	21,416.98
Other.....	49,240.18	-----	-----	-----	49,240.18
Grand total.....	2,290,145.53	5,940,834.59	4,858,661.16	14,425.85	13,104,067.13

¹ Before final settlement of all accounts by the General Accounting Office.

² Estimated.

³ Includes \$56,483.17 collected in California under act of Oct. 2, 1917 (40 Stat. 297).

⁴ Includes \$24,692.16 collected in Wyoming under act of June 26, 1926 (44 Stat. 1621), \$188,196.48 collected in California under Executive Order 9087 dated Mar. 5, 1942, \$18,098.48 collected in Alaska, and \$3,323.41 collected in Nevada.

⁵ Range improvement fund.

⁶ Includes \$112.50 from sales of reserved reclamation lands.

Grazing Service¹

C. L. FORSLING, *Director*



SATISFACTORY progress was made toward the achievement of most of the major conservation programs undertaken by the Grazing Service during the fiscal year 1946. These objectives were centered mainly on the most urgent problems of range administration in the several grazing districts, the success of which hinges on an equitable distribution of grazing privileges among the various users coupled with better management of the range itself. Included in the broad aspects of range management are the recurring jobs of range surveys, dependent property checks, and periodical review of previous actions pertaining to grazing permits, especially where former action on permits was based upon insufficient data to safeguard the interest of the Federal Government in this connection.

While the surrender of Japan brought a sudden reduction of certain essential war activities (such as the construction of access roads), the transition to increased peacetime activities enlarged the grazing district work in many directions. For example, the wartime military requirements for vast areas of grazing district lands for training and testing grounds relaxed considerably after the historic test of the atomic bomb in New Mexico on July 16, 1945. As a consequence, work on land matters as an element of postwar readjustment increased noticeably as the year advanced. The affairs of hundreds of people are involved in the 14 million acres of grazing-district lands which were used for military purposes—people who formerly had permits to graze these lands, or who otherwise had become “displaced persons” as a result of military needs in the areas. These circumstances required much study and attention on the part of Grazing Service officials in a number of grazing districts.

The proposed irrigation and basin development programs of the Bureau of Reclamation will affect practically all of the grazing districts in one way or another. In turn, the contributions which the watershed and forage-producing potentials of these districts make to the major program will be governed largely by the kind of management that these upstream areas

¹ On July 16, 1946, the Grazing Service was merged with the General Land Office by Executive order under the Reorganization Act of 1945. This order abolished the two agencies and placed them, together with their respective functions, in the Bureau of Land Management, Department of the Interior.

receive. This called for general and specific investigations of the grazing district lands in the light of their condition and present occupancy to determine the proper place of the Federal range in the over-all basin program. Situations pertaining to streamflow, silt, and watershed conditions, and grazing needs, wildlife protection, and related matters were considered and reported upon for the use of agencies and individuals concerned.

Range Administration

Range conditions generally were favorable during the year in most districts, exceptions being in the Southwest and the extreme north where drought persisted during most of the fiscal year. From the southern parts of Arizona and New Mexico the drought extended into adjacent areas in Utah, Nevada, and Colorado. In these areas shortages of range feed and deficient water supplies caused some losses and prompted the movement of many livestock to irrigated pastures, where available, and to distant grazing lands.

According to Weather Bureau records and experience, severe drought occurs on the western range lands about 3 years out of 10. During recent years, substantially coinciding with war years, the range lands within the Upper Colorado, the Upper Missouri, the Snake, and the Great Basin drainages have received better than average moisture. Generally speaking, forage and crop conditions have been good. The odds are against a continued period of "wet" years over this area as a whole. It is the aim of the Grazing Service to attain conservative stocking of the Federal range in order to have a carry-over of forage to cushion the "dry" years. Many operators support this view, although in the midst of consumer demand at high prices it is not surprising that some should insist on full harvest of the forage crop each year as a means to greater immediate returns. On the whole, the growers have cooperated fully by reducing numbers or holding the line against increasing numbers. Many have culled their herds of low-grade, unprofitable animals.

Increased activity in real estate transactions, involving sale of base property and the consequent requests for transfer of grazing privileges, created additional demands on the Service during the year. Range surveys to determine proper capacities of areas previously unsurveyed and re-examinations of certain areas were resumed after the return to duty of trained men who had been on military furlough. Original extensive surveys covered 3,340,354 acres and rechecks covered 4,412,286 acres. Both public and intermingled private grazing lands were involved. Of this total, 2,281,333 acres are within soil and moisture conservation project areas.

Certain controversies, centering on the questions of grazing capacities and proper use of base properties in several grazing districts, were resolved satisfactorily during the year. However, owing to the enforced wartime lapse of certain fundamental grazing district activities, primarily due to the

absence of trained personnel who were serving in the war, there still remains much to be done in many districts before term permits and other objectives of the Taylor Grazing Act can be considered to be on a stabilized basis. Regulation of range use under the license and permit system has been a potent factor in promoting both conservation of the resources and stability in the western range livestock industry. Those who have base property and are licensed to use the range now have reasonable assurance that the proper share of forage will be available to them at the proper time. There is a pressing need for the completion of a comprehensive range appraisal to serve as a basis for determining a reasonable grazing fee to be charged for the use of the Federal range. Also, many areas presently underused and others overused, due to existing circumstances, need to be brought under proper use. This can be accomplished by more water development and other improvements on outlying areas that are now used only slightly, if at all. Such a program—estimates for which have been prepared—would aid immeasurably in relieving or abating damage on presently congested areas. Eroded lands and areas that were devastated of forage by fire should be rehabilitated, and on such areas adequate means for the control of both livestock and wildlife are necessary.

Licenses and permits.—A total of 9,397,756 livestock grazed the Federal range under permits and licenses during the year, representing a net reduction of 621,422 head as compared to the previous year. Most of this reduction was in sheep which showed a decrease of 671,568 head. Cattle numbers increased 68,326 head. The number of licensed operators was reduced slightly from 21,650 to 21,329. The statistical detail is shown by regions in table 1. Weights of marketable livestock as well as numbers marketed from the Federal range were above average. Favorable conditions in the northern regions influenced this situation where better lamb and calf crops prevailed.

TABLE 1.—Number of licensed operators and livestock in grazing districts by regions, June 30, 1946

Region	Licensed operators	Cattle	Horses	Sheep	Goats	Total livestock
Arizona.....	563	87,572	2,102	61,585	8,934	160,193
Colorado.....	2,100	189,520	6,866	767,580	154	963,920
Idaho.....	3,269	235,280	15,766	963,139	15	1,214,200
Montana.....	3,118	295,457	22,978	916,912	32	1,235,379
Nevada, California.....	1,573	444,288	17,578	791,253	2,601	1,255,720
New Mexico.....	3,921	280,960	14,263	587,238	41,961	924,422
Oregon.....	1,473	237,037	12,575	240,527	-----	490,139
Utah.....	3,898	196,280	6,609	1,506,385	5,050	1,714,324
Wyoming.....	1,414	178,378	10,331	1,250,725	25	1,439,459
Total.....	21,329	2,144,772	108,868	7,085,344	58,772	9,397,756

Wildlife.—Big game in grazing districts decreased about 2½ percent, totaling 569,186 head, as compared to 583,432 head the previous year. The largest reduction was in antelope, there being 19,434 fewer such animals. Deer increased 4,291 head and elk increased 895 head. Game-

management plans were formulated in cooperation with State agencies aimed at breaking up the concentrations of game where such conditions are a detriment to both range and wildlife. Certain transplanting was accomplished with success. Water developments of special types and other range improvements made possible by the Pittman-Robertson Act have been very beneficial to the welfare of upland birds and big game in grazing districts. Wildlife representation on advisory boards is helpful in the solution of game problems. This type of activity was extended to regional and national levels during the year, wherein wildlife problems of general concern are discussed and solutions sought. One of the first results of such discussions was the establishment of bag limits and hunting dates in certain States for the current season, area by area, according to prevailing conditions, as recommended by the wildlife committees. Cooperative activities looking to better wildlife conditions in grazing districts were extended in a number of localities during the year.

Range studies.—Field studies to complete the inventory of resources under Grazing Service administration were pursued so far as available funds would permit. Procedures incident to the increasing number of permit transfers resulting from sales of ranch base property were reviewed preparatory to reducing paper work entailed by such transactions. Field work in a number of districts was directed toward getting more authentic information on actual use of the range to serve as a recheck on the former grazing capacity estimates. This, in turn, will form the basis for making the necessary adjustments in authorized range use in those areas.

A number of cases involving grazing permits of some years' standing were reviewed during the year. As a whole this review centered on the question of compliance with the Federal Range Code which provides, in part: "To promote the highest use of the public lands within grazing districts which have been or hereafter are established, possession of sufficient land or water to insure a year-round operation for a certain number of livestock in connection with the use of the public domain will be required of all users." Four main points are stressed in this connection: (1) The permittee must own (or control through acceptable lease) adequate property which is qualified by dependency by use to the extent of the base property requirement of each area in which he has grazing privileges; (2) the available Federal range must have been adjudicated proportionately among all qualified applicants according to their respective qualifications; (3) the total grazing privileges granted in a unit or allotment must be within the grazing capacity of the area; (4) all permittees must possess sufficient land and water to insure a year-round operation for the permitted number of livestock. This procedure resulted in better coordination among district graziers and the advisory boards and the amendment of current 10-year grazing permits in a number of cases. During the period of this review it was necessary to suspend the issuance of term permits until

the latter part of the fiscal year, and this job, involving nearly 22,000 live-stock operators, is now about two-thirds completed.

Cooperative studies with the Oregon State Agricultural College at the Squaw Butte-Harney Range and Livestock Station continued during the year with emphasis being placed upon the effects of controlled range management on livestock husbandry and natural reproduction of native vegetation. Studies at this station are applicable to large areas of surrounding Federal range in four States. Studies to determine practical answers to the problems of rotation grazing, mineral deficiencies in native forage, and proper seasons of use over widely scattered areas were conducted in cooperation with individual permittees. Cooperation was continued with the University of Wyoming on the Church Buttes and Hadsell area studies. In the latter case an effort is made to determine the effect of supplemental feeding of sheep on mineral-deficient winter ranges. At the Church Buttes station records are being kept on dual use of selected ranges by cattle and sheep to determine questions of range management in areas where the two classes of stock compete for the same range.

Trespass.—Enforcement of the rules of the range was handicapped to some extent by manpower shortages. Complaints were investigated so far as possible, but it was impossible to apprehend all offenses. Trespass action was taken on 132 cases in which voluntary propositions of settlement for damages to the United States were accepted. Five cases of willful violations were turned over to the Department of Justice for jurisdiction in Federal courts. Removal of surplus trespassing horses mainly through private enterprise and voluntary action of permittees continued but on a reduced scale from that of previous years and indications are that the program inaugurated in 1943 to rid the range of "star boarders" is bringing satisfactory results. Notable success was reported from Wyoming and Montana grazing districts. An effort was made to encourage disposal of such animals to the war-devastated countries of Europe to help relieve shortages of farm animals and protein food supplies in those areas. The diversion of surplus horses from the range into useful channels in this way helps to conserve the forage and rehabilitate war-torn people.

Hearings and appeals.—On July 1, 1945, there were 89 pending appeals from decisions of district graziers, carried over from the previous year. During the 1946 fiscal year 96 additional appeals were filed and hearings requested, making a total of 185.

There were 77 appeals disposed of during the fiscal year. Hearings were held in 37 cases; 22 were settled by the examiner, or were withdrawn after being set for hearing; and 18 were withdrawn or settled by stipulation in the field. From the decisions of the examiner in 37 cases, 7 were appealed to the Secretary. Of these seven, one was withdrawn before a decision was rendered by the Secretary, decisions were rendered in four cases, and the decisions on two cases are pending.

A review of past years' hearings work indicates that the number of appeals filed in 1946—96 in number—is an all-time low. As of July 1, 1946, there are 108 pending appeals.

Land Planning and Utilization

During the fiscal year 1946 the Grazing Service administered 60 grazing districts, with a gross area of 264,609,700 acres. Of this total approximately 145,777,000 acres are Federal range and the remainder is mainly in private, State, and county ownership. Approximately 14,000,000 acres of the Federal range area is public land in certain withdrawn status but administered by the Grazing Service under cooperative agreements with other Federal agencies. Pierce Act leases in 6 States totaled 1,053,200 acres, and the area withdrawn by establishment of grazing districts totaled 130,683,965 acres.

Military uses of grazing district lands.—Military requirements for land uses in grazing districts took a sudden downward trend following the successful test of the atomic bomb. This test took place in July 1945 on the Las Cruces-Alamogordo bombing range within New Mexico grazing district No. 4 (Tularosa). VJ-day, which followed within 2 months of this momentous occasion, hastened the return of American fighting forces from all corners of the world and the ultimate reconversion of millions of acres of grazing lands from war to peacetime pursuits.

As a result of revocation of a number of withdrawals and special land-use permits, the total area of public land used for military purposes has been reduced from a wartime peak of 14,428,919 acres to 6,533,461 acres on June 30, 1946. This reduction is due largely to the revocation of several large special-use permits involving land used temporarily for maneuvers in Oregon and Arizona. Since substantially all of the withdrawals and special land-use permits provide for the return of the administration of the lands to the agencies under whose jurisdiction they were administered prior to the war, it is anticipated that a large part of the land ultimately will be placed under grazing administration.

Plans for the administration and restoration of such lands were formulated during the year. Large areas will need to be rehabilitated. It is estimated that nearly 2 million acres of public lands temporarily set aside for military uses will require rehabilitation as a result of such activities. Private lands within grazing districts that were purchased by the military establishments, if returned to private ownership, will need to be considered in connection with other land problems in grazing districts. It is the belief of the Grazing Service that substantially all of the public lands in grazing districts which have become, or are about to become, surplus from a military standpoint are suitable for administration under the Taylor Grazing Act for grazing, watershed, and other purposes.

Land plans.—Lands now used for military purposes when restored to grazing use will be included in the over-all land planning program which seeks to simplify the ownership pattern in grazing districts and the administration of public lands. Simplification of the pattern can be achieved through exchanges, leasing under the Pierce Act, exchange of use, cooperative agreements, sale of isolated tracts, development of selected tracts under basin programs, and modification of grazing-district boundaries.

Land plans to accomplish the above objectives have been formulated and are now under consideration in 14 areas, some of which involve entire grazing districts. This has had a tendency to push the exchange of lands with States looking to the mutual advantage of the States and the Federal Government. Land planning in grazing districts contemplates better administration and utilization of all the associated lands in the area, including grazing, recreation, wildlife conservation, and watershed protection.

Drainage basin studies.—Studies of grazing-district lands within the Arkansas, Bonneville, Colorado, Columbia, Lahontan, Missouri, and Rio Grande basins were conducted in connection with the proposed basin development programs in accordance with the interagency plan sponsored by the Bureau of Reclamation. Investigations designed to fit the use and management of grazing lands of the Upper Missouri basin into the broad basin development program were pursued in 11 grazing districts involving 13½ million acres of the Federal range.

Reports covering range, watershed, and livestock situations in grazing districts within the seven drainage basins were submitted to the Bureau of Reclamation to be incorporated into plans for basin-wide studies. Substantially all of the land under Grazing Service administration is embraced within the drainage basins mentioned. Future irrigation and flood-control projects therein must essentially take into account the grazing lands and the associated base properties that will affect and be affected by the basin programs. Field investigations will be required in order to resolve local problems and harmonize basic policy. This work will involve close coordination of all land use in the areas and full cooperation to attain full benefits from the land and its resources on a sustained-yield-conservation basis.

Land classification.—At the beginning of the year 395 individual land cases were pending within grazing districts under sections 6, 7, 8, and 14 of the Taylor Grazing Act, the 5-acre tract law of 1938, and other public-land laws. A total of 714 new cases was received during the year and 783 disposed of, leaving 326 pending at the close of the year.

Administrative Management

The Service continued to be handicapped by abnormal turn-over in personnel occasioned by the close of the war. Of the 204 employees on

military furlough at the beginning of the year, 107 returned to duty, 7 requested extended leave without pay, 31 were separated by resignation or otherwise, 3 were killed in action, and 56 were still on military duty at the close of the year. Many of those with military-preference rights, along with others, were separated during the final week of the fiscal year by reduction in force due to curtailment of salary and expense funds for the fiscal year 1947. This curtailment placed a limit on the number of persons to be employed on the salaries-and-expenses rolls, requiring a reduction of 79 percent in civil-service employments. To meet this situation, it was necessary to abolish certain important functions and to separate about 200 employees, some of whom had had more than 20 years of faithful Government service and others who had barely been reestablished in their former positions after military service of from several months to several years.

Since grazing-district work consists primarily of action programs on the ground, the field coverage of such activities was disrupted, many field stations necessarily closed, and four regional headquarters abolished on June 30, 1946.

A small number of pieces of automotive equipment and other heavy equipment were obtained by purchase from surplus disposal agencies. However, this was not nearly enough to effect any material replacement of worn out units. Expenditures for upkeep of old equipment for which there have been no replacements during recent years have exceeded value received, but there appears no alternative if the demands occasioned by emergency fire fighting and other work in grazing districts are to be met.

Administrative audits and grazing-district inspections were confined to absolute minimum requirements due to personnel shortages. The audit program is badly in arrears because the one qualified auditor has been occupied almost full time on other pressing work. For efficient business administration it has been shown that the regional offices should be covered by an audit at least once each year.

Steps were taken during the year to reduce the regional offices from nine to five for purposes of economy, and efforts were made to put more personnel on the ground where grazing control and the protection of natural resources need to be strengthened.

Grazing Service employees purchased \$164,950.79 (purchase price) worth of war and victory bonds during the fiscal year 1946 through the pay-roll deduction plan. Withholding taxes aggregated \$167,225.67.

Appropriations and allotments.—Administrative funds provided by the Congress for the fiscal year 1946 totaled \$1,121,470. In addition, \$115,000 was appropriated for the construction and maintenance of range improvements, and \$7,500 for leasing of lands under the Pierce Act. Allotments for fire protection and for soil and moisture conservation work totaled \$585,750.

Thes following working funds were transferred to the Grazing Service during the fiscal year 1946 for the performance of work assigned on specific projects:

From the Public Roads Administration for the construction and main- tenance of access roads to mineral deposits and other strategic materials_	\$246, 569
From the Bureau of Reclamation for use in the Missouri River Basin studies_-----	10, 300

Funds transferred from the Public Roads Administration during the 4-year period ending June 30, 1946, total \$3,138,069.

Grazing fees.—The earned grazing fees in the grazing districts during the fiscal year 1946 aggregated \$736,266.70, by States as follows: Arizona, \$32,557.62; California, \$20,139.11; Colorado, \$46,416.04; Idaho, \$69,-877.25; Montana, \$62,872.06; Nevada, \$114,487.08; New Mexico, \$103,-542.47; Oregon, \$59,354.14; Utah, \$125,844.08; and Wyoming, \$101,176.85.

Of this amount, \$231.84 was deposited to the credit of the Indians and \$368,017.46 was paid to the States affected under the provisions of the Taylor Grazing Act, bringing the total state revenues from this source to \$3,812,650.04 during the 11-year period 1936–46.

Contributions received.—Contributed funds in the aggregate amount of \$67,505.24 were accepted under section 9 of the Taylor Grazing Act from 8 of the 10 States in which grazing districts have been established. These contributions are listed by States as follows: Arizona, \$1,458.25; Colorado, \$17,718.80; Idaho, \$14,984.44; Montana, \$7,737.89; Nevada, \$6,857.71; Oregon, \$1,808.15; Utah, \$7,500; and Wyoming, \$9,440.

The amount of such contribution since the inception of grazing-district administration totals \$730,632.14.

Range Improvement and Maintenance

Range improvements, consisting primarily of water developments, truck trails, fences, bridges, corrals, cattleguards, and related facilities that have been placed on the Federal range at public expense since the inception of grazing-district administration, had an estimated residual value of \$10,-000,000 on June 30, 1945. Certain additional facilities were installed during the fiscal year 1946 but, due to many limiting factors, chief of which were the shortages of funds and equipment, it was necessary to stress the maintenance of existing projects and minimize the program of new construction. Contributions, mainly in the form of labor and materials by individual stockmen and the advisory boards, supplemented regular appropriations and, to an important extent, aided in the conservation and development program of the Grazing Service. New construction, financed largely from contributed funds, included completion of water developments previously undertaken, fencing, truck trails, stock trails, and driveways to

facilitate better use and management of the range. Funds appropriated for range improvements and maintenance amounted to only about 1 percent of the capital value of structures needing maintenance. Consequently the needed upkeep of many important structures and other installations had to be neglected. Improvement projects on the Federal range that should be maintained in the public interest are of wide scope and variety, although there are others of equal importance to conservation but of direct benefit to individuals on which the cost of upkeep should be assumed by the stockmen who use them. A summary of range improvements with accumulative totals is shown in table 2.

TABLE 2.—*Cumulative summary of range-improvement projects in grazing districts, 1935-46*

Type of project	Unit	Completed fiscal year 1946	Total completed or acquired from Apr. 1, 1935, to June 30, 1946
Spring developments.....	Number	34	2, 117
Reservoirs (stock water).....	do	376	3, 843
Wells (stock water).....	do	53	877
Pipe and tile lines.....	Miles	6. 8	70. 1
Ditches.....	do		58. 5
Truck trails.....	do	267. 9	1 10, 784. 5
Stock trails.....	do	24. 8	1, 705. 2
Stock driveways.....	do	15	1, 486. 9
Bridges, livestock (over 20-foot span).....	Number		69
Bridges, vehicle (over 20-foot span).....	do	1	113
Fences.....	Miles	327. 1	7, 463. 7
Corrals and holding traps.....	Number	18	464
Cattle guards.....	do	34	770
Dipping vats.....	do	1	8
Telephone lines.....	Miles		380. 7
Firebreaks.....	do	468	4, 571
Boundary marking.....	do	85	4, 814. 5

¹ Includes access-mine roads.

Under section 4 of the act, 590 permits were issued to range users during the year to construct and maintain range improvements in grazing districts, bringing the total of such permits issued to date to 4,514. Construction permits within this provision totaled 401 for the period of this report involving improvements valued at \$260,724. Maintenance permits issued in 1946 covered 189 existing privately owned facilities valued at \$1,175,345, and used in the care and handling of permitted livestock.

Soil and moisture conservation.—Special attention was given to “sore-spot” areas through the soil and moisture conservation program authorized by Reorganization Plan No. IV of 1940. Areas that were seriously denuded and eroded before the passage of the Taylor Grazing Act were given artificial treatment so far as facilities would permit. Natural recovery in some areas has resulted from controlled grazing, while on many other areas the top soil had already been destroyed and erosion had progressed so far that grazing control alone is inadequate to restore the land to a stable soil and

vegetative condition. Soil and moisture conservation work was conducted on 120 projects during the year, an increase of 6 over the previous year.

In the restoration of depleted areas, the watering places are closed during the growing season and drift fences are constructed for more positive control. Attention is then directed to the maintenance needs of areas that are in fair to good condition, as well as to the corrections necessary to restore depleted areas. In relieving the congested areas, care is taken to avoid overgrazing of adjacent lands. This requires systematic field checks to segregate areas overgrazed as compared to areas lightly used and unused and to appraise progress and methods. Needed improvements to gain effective control and rehabilitation are studied as a basis for future action.

Six major types of work were conducted with encouraging results on soil and moisture areas within grazing districts during the year. These include water development and maintenance, fencing, contouring, brush control, rodent control, and reseeded. Of the 32,842 acres reseeded during the year, 22,957 acres are within approved soil and moisture conservation areas. Water-development and maintenance work involved 201 units, and rodent control was conducted on 13,764 acres.

Access roads.—The access-road program, to facilitate war production of strategic materials, was virtually brought to a close during the year. Two projects remained to be completed. A total of 78.8 miles of such roads was constructed during the year, bringing the total to 1,975 in 4 years by States as follows: Arizona, 196; Colorado, 335.4; Idaho, 79.5; Montana, 96.3; Nevada, 167.4; New Mexico, 149.2; Utah, 885; Wyoming, 66.2. Considerable mileage is of permanent nature and is now serving in important industrial and administrative capacities. Some feasible provision is necessary for future maintenance of these feeder lines in the general interest of the vast area which they serve.

Fire control.—There were 606 reportable fires on the Federal range during the 1945 calendar year, resulting in a burn of 653,961 acres, of which 511,370 acres are Federal range and 142,591 acres are intermingled State and private lands. The average area burned yearly in grazing districts during the past 5 years is 1,075,800 acres, about 70 percent of which is Federal range. Damage consisting of forage losses, cost of reseeding devastated areas, woodland and timber values destroyed, watershed depletion, soil and moisture losses, livestock losses, and the replacement of destroyed range improvements is estimated at \$1,735,627 for the year ending December 31, 1945. (Fire records are kept on a calendar year basis to conform with those of cooperating agencies.)

About 73 percent of the fires were man-caused, which stresses the need for vigilance and education in prevention of fires. More than 95 percent of the Federal range acreage burned in 1945 is in Oregon, Idaho, Nevada, and California, where devastation of the range threatens both private and

public property of inestimable value, in addition to damage in the burned areas.

During the past year the cooperating States have been encouraged to continue the forest and range fire-fighting organizations set up under the wartime office of civilian defense plan. Notable progress was achieved in Nevada, Utah, and Montana. Cooperation with all other Federal agencies was renewed and continued and, in the case of Idaho, an effective agreement was entered into with the State wherein State and Federal lands in grazing districts are given additional protection through State contributions.

An analysis of the range-fire situation has brought to light a number of conclusive facts, among which are: (1) The need for more funds for presuppression work. Costs have increased enormously in recent years. (2) The need for more fire equipment to prevent and control fires. (3) Additional permanent fire-control personnel, well trained, and adequately equipped. Due to the many handicaps occasioned by equipment and personnel shortages, parched ranges, and added fire hazards, the outlook for 1946 is far from good.

Safety.—In the operation of 431 motor vehicles under Grazing Service responsibility, involving a total mileage of 3,497,674, there were 9 accidents, none of which were fatal to life. Damage to Government vehicles totaled \$1,103 and to private property \$82.50. In the operation of all kinds of equipment, including automotive, 41 accidents were reported, of which 26 were only minor and 15 caused lost time totaling 370 man-days. Thirty-two of the accidents occurred on construction work.

Fish and Wildlife Service

ALBERT M. DAY, *Director*



THIS report on the status of the wildlife resources of the Nation seeks to show how these resources have been affected for good or ill by the years of war. It seeks also to make clear how the activities of a Nation reconverting to peace can disturb the delicate balance between all the birds, fishes, mammals, and other wildlife and their environment, and to show what we must do to maintain a favorable balance.

In some respects, peace can be harder on wildlife than war. Whatever unfavorable elements the war years introduced, such as increased pollution of waterways, they at least resulted in a temporary reduction in hunting and fishing, giving wildlife populations some opportunity to restore past losses. But this respite came to an end even before the termination of the war, with a sharp upturn in the number of licenses issued to hunters and anglers, and clear indications that within a few years the number of sportsmen may be double the prewar figure.

Not only will there be more gunners and fishermen in the field, but wilderness areas that have hitherto been natural and almost inviolate sanctuaries for wildlife will become more and more accessible through all the devices of a modern, mechanized civilization. Moreover, the large scale development of the Nation's river systems, substituting an artificial environment of dams, impoundments, and irrigation ditches for the natural one of river bottomlands and marshes, demands the most careful planning and the most unremitting effort if the effect upon wildlife in these areas is not to be serious and irremediable.

As the wildlife resources, with all their inherent recreational, economic, and social values, are the property of all the people, so the task of preserving, rebuilding, and developing these resources is a public responsibility. With certain exceptions, the actual administration of the wildlife resources is carried out by the Governments of the various States. The function of the Federal Government in this field is to carry on, independently or co-operatively, the fundamental research needed to give direction and meaning to wildlife restoration programs, to carry out cooperatively with the States specific control or management programs, and for such resources as the Alaska fisheries or the migratory game birds, to manage these resources for the public benefit.

Status of Migratory Game Birds

Of all the migratory game birds sought by United States hunters, waterfowl are the most important from the standpoint of their number, their wide distribution, and the fact that they are hunted by more sportsmen than any other birds. Nevertheless, the population of ducks and geese has been declining since 1944. By the spring of 1946 this decline had assumed such proportions as to be considered alarming.

The continental population of waterfowl reached its lowest point in 1934, when it was estimated to total 27,000,000 birds. As a result of drastic curtailment of hunting privileges, coupled with improvement in conditions on the breeding and wintering grounds of the birds, the waterfowl population thereafter gradually increased, numbering 125,000,000 by 1944.

A reversal of this favorable trend first became apparent in 1945, when the annual inventory of waterfowl, taken each year in January, indicated a population of only 105,000,000 birds. This decline was confirmed by observations of the spring and fall migrations in 1945.

The January 1946 inventory, conducted by the same methods that have been used in each of the annual surveys, had the benefit of exceptionally good coverage, both surface and aerial. The planes and surface craft belonging to the Service were supplemented by those belonging to the States, the Coast Guard, the Naval Air Service, and the Army Air Forces. The results showed additional heavy losses, indicating a total continental population of approximately 80,000,000.

An analysis of inventory results showed that, with only two exceptions, all species of game ducks had suffered losses. The exceptions were the black duck or "black mallard," which was recorded in about the same numbers as in 1945, and the blue-winged teal, which showed a slight increase. These bright spots, however, were completely obliterated by losses among such favorites as the mallard, pintail, green-winged teal, scaups, redhead, and canvasbacks. Among the geese, although the blue goose, cackling goose, and both species of brant registered gratifying increases, these were largely offset by losses suffered by the more popular Canada and white-fronted geese. The status of the Canada geese in the Mississippi Flyway was found to be so seriously impaired that complete closure was announced for the 1946 season in Alexander County, Ill., with the recommendation that the entire flyway be closed to the hunting of this species.

Study of reports covering the spring migration of 1946 provides additional verification of the results obtained from the January inventory. On a percentage basis, 28 percent of the observers reported no change, 11 percent noted an increase, while 61 percent recorded a decrease. Comparable percentage figures for the spring migration of 1945 were 36, 28, and 36; those for the spring migration of 1944, 34, 54, and 12.

Among game birds other than waterfowl, some species were in satisfactory abundance while others declined or showed little change.

Studies of check breeding areas of the woodcock in New Brunswick, Nova Scotia, Prince Edward Island, Maine, and Pennsylvania indicate that this species is holding its own. On some of the areas an increase of 2 or 3 percent was recorded.

Wilson's snipe continued to be a problem species. Despite the fact that it has had full protection for several years, it continued to lose ground until 1945 when, on a Nation-wide basis, a slight gain was recorded. Most of the reports of increase have come from Louisiana and Florida where winter concentrations are found. The problem of proper management of both the woodcock and Wilson's snipe is most complex, apparently involving factors not well understood at present.

The production of mourning doves during the 1945 season was normal, and it would seem that this species has now largely or fully recovered from the heavy losses that resulted from the severe winter of 1940. Nevertheless, sound management principles based on scientific findings must be applied to this species if its status as a popular game bird is to be maintained.

A biological study of the white-winged dove in Texas and Arizona has been carried on for several years to provide information needed for maintaining this species. Despite a very short open season provided for the Lower Rio Grande section, the 1945 kill in Texas was entirely too heavy, amounting to 40 or 50 percent of the entire population of the Rio Grande Valley. With no increase of brood stock, and the continued clearing of the nesting habitat, it is obvious that drastic measures may be necessary to protect this bird in that region. Fortunately the status of the white-wing in Arizona was about normal, but here the total kill by hunters is much less, chiefly because the birds are dispersed over wide areas. A check during the hunting season showed that about 92 percent of the birds taken in Arizona were of that season's crop.

In 1945 the band-tailed pigeon was found in fair numbers locally throughout the Pacific coast region. Some increase was recorded in Colorado and probably also in New Mexico. A recent report from the State of Washington indicates that these birds have suffered considerable losses, probably due to unsportsmanlike methods of hunting that are in vogue in some places in the Pacific Coast States. Normally, these birds lay but one egg, so populations may be decimated in a single hunting season. A comprehensive report on the conservation and management of this species is in the process of publication.

The status of the sora and other rails is considered satisfactory.

Reports on the numerical status of the coot indicate a decreased population.

National Wildlife Refuges

All the forces of modern civilization—the growth of cities, the expansion of industries, the harnessing of waterways for power and irrigation, the expansion of highways and airports—normally work to reduce the land and

water areas that are suitable for wildlife. To balance this tendency, a variety of land and water areas must be set apart and maintained for the primary purpose of providing for the needs of wildlife. The national wildlife refuges administered by the Fish and Wildlife Service are such areas. They are an indispensable tool in managing and maintaining wildlife in our modern world, at best a difficult one for the creatures of land and water.

Although the basic idea of wildlife refuges was conceived early in the present century, the modern refuge system has been in existence only about 10 years. This system of refuges has rendered an inestimable service by protecting wildlife from the danger of severe reduction or extinction, thus preserving for the public the economic, esthetic, and social values inherent in the possession of this living resource.

The importance of maintaining and enlarging the national wildlife refuge system as a stabilized protective measure for wildlife is emphasized by the sharp reduction in the continental population of migratory waterfowl that has occurred since 1944. It is estimated that at least one out of every five ducks, geese, and swans in North America uses these refuges at some time during the year, finding in them protected nesting, feeding, and resting areas.

The number of national wildlife refuges now administered by the Service is 291 (17,819,495 acres) (table 1), of which 271 (9,889,856 acres) are in the United States and 20 (7,929,639 acres) in Alaska, Hawaii, and Puerto Rico.

The Migratory Bird Conservation Commission approved the purchase of 22,796 acres of land in 13 units during the year. One of these was a new refuge and the remaining purchases were for consolidation of existing ones. In addition, the Commission approved the lease of 318,528 acres of land in three units, two of which involved the establishment of new national wildlife refuges. The Commission's approval of the purchase of 11,275 acres of land in the Laguna Atascosa area in Texas establishes a long needed refuge in that important waterfowl wintering ground. The two new refuges on leased lands are the large Everglades section of southern Florida, and the area around Sanibel Island on the western coast of Florida. The Sanibel National Wildlife Refuge, containing 2,394 acres in Lee County, Fla., was secured by lease on December 1, 1945, from the State of Florida. This is probably the best area north of the Everglades for the roseate spoonbill, black-necked stilt, man-o-war bird, and other rarities.

Executive orders were promulgated establishing two new refuges. The Theodore Roosevelt National Wildlife Refuge was established on 61,539 acres of land in Billings and McKenzie Counties, N. Dak., formerly under jurisdiction of the National Park Service. The Tennessee National Wildlife Refuge was established on 54,365 acres of land in Benton, Decatur, Henry, and Humphreys Counties, Tenn., acquired by the Tennessee Valley Authority for its Kentucky Dam and Reservoir project on the Tennessee River.

Public land orders were issued establishing two new refuges, the Tishomingo National Wildlife Refuge on 13,449 acres of land in Johnston and Marshall Counties, Okla., and the Hagerman National Wildlife Refuge on 11,429 acres of land in Grayson County, Tex. The lands embraced in the two units were acquired by the War Department for the Denison Dam and Reservoir project on the Red River. These two areas provide managed protection for waterfowl in a part of the Central or Plains Flyway where suitable areas are badly needed.

One of the important activities this year was the development of newly acquired national wildlife refuges on the Tennessee Reservoir in Kentucky and Tennessee and on Lake Texoma in Texas and Oklahoma. In addition to carrying on development work within the refuges, the Fish and Wildlife Service also gave assistance to the State conservation departments and to the United States Corps of Engineers in the planning and development of waterfowl management areas on these extensive reservoirs. Planting activities, which were an important part of this work, required the collection of enormous supplies of seed on other refuges.

In an effort to afford greater protection to the rapidly declining population of Canada geese, several hundred acres of waterfowl feeding areas were developed along the Mississippi flyway. Steps were taken to increase the usefulness of feeding grounds already available.

The establishment of an additional breeding colony of trumpeter swans was aided by the transfer of 20 cygnets from the Red Rock Lakes Refuge, Mont., to the Malheur Refuge in southeastern Oregon. This increases to 37 the number of young swans now on Malheur. The feeding of the swans during the winter at Red Rock Lakes has continued to hold the breeding population there during the critical season when food and protection are paramount. The present known population of this species—once on the verge of extinction—is 301.

A special effort has been made through cooperative means to increase the refuge acreage planted to grain crops. This not only keeps fields free of weeds, provides goose browse and excellent upland game areas, but also furnishes grain for waterfowl, supplementing the extensive crops of aquatic and marsh plant seeds. The production of cultivated crops on the refuges has also proved to be important in alleviating waterfowl damage to farm crops.

The cultivation of about 30,000 acres of refuge lands by private individuals and refuge personnel in 1945 produced 489,223 bushels of grain and other crops. Other economic uses not inconsistent with proper wildlife management of the refuges were encouraged. A total of 253,490 animal-use months of grazing was permitted on 512,088 acres of grasslands principally after the waterfowl and upland game bird nesting season. In addition, 13,589 tons of hay were harvested on these areas.

The sale of timber products in 1945 was more than double any former year's sale. The removal of selected timber for saw logs, cord wood, and

other raw materials is an important wildlife management tool on certain refuges and in addition results in a substantial contribution of materials to aid in the critical lumber shortage.

The total revenue for this fiscal year from all economic uses on the national wildlife refuges, including the disposition of big-game animals, fur animals, and surplus products, was \$350,631, which was deposited in the Treasury.

The relaxing of wartime restrictions has been responsible for a marked increase in the use of refuges for recreational purposes. In 1945, 165,798 man-days of recreational fishing resulted in a take of 772,849 fishes. Commercial fishermen removed 894,358 pounds of rough fish.

Improved management practices are responsible for the increased production of fur animals on Federal refuges. At present there are 60 refuges on which fur animals are taken annually, principally on a share cropping basis with the trappers receiving 40 to 50 percent of the annual crop as their payment for trapping. During the fiscal year 1945 the return from the Government's share of furs from wildlife refuges amounted to approximately \$140,000.

To maintain the herds of big-game animals on the four fenced big game refuges at a level consistent with the available range, 294 buffaloes, 91 elk, 100 mule deer and 15 white-tailed deer, and 54 Texas longhorns were transferred to State conservation commissions for restocking or were sold or donated for exhibition, propagation, or food. Permits issued to 7 State conservation departments authorized removal of 1,975 deer, 40 elk, 790 fur animals, and 500 ring-necked pheasants for restocking depleted ranges.

Maintenance of buildings and maintenance or replacement of worn-out equipment during the war years has presented a major problem due to shortages of materials and inability to purchase new units. Most of the automotive equipment is 5 to 9 years old and it is becoming increasingly expensive to operate. Replacement of this equipment is expected to cover at least a 5-year period because of the magnitude of the funds required and the slow rate of availability.

On many refuges deterioration of dikes and damage to water-control structures, fences, and trails have resulted from inability to provide the necessary manpower and materials to keep them in proper repair. With the return of former refuge employees who have been in the armed services and with the providing of additional funds it is expected that these areas can be placed in good operating condition.

During the past year engineering developments were undertaken on the Sutter and Colusa Refuges in the Sacramento Valley of California, on the Hagerman and Tishomingo Refuges on the Red River between Texas and Oklahoma, on the Seney Refuge in Michigan, and on the Sabine Refuge in Louisiana. Plans were completed for similar developments on the Horicon and Necedah Refuges in Wisconsin.

TABLE 1.—*Classification and acreage of national wildlife refuges administered by the Fish and Wildlife Service in United States and Territories*

Classification	Number	Acres
For migratory waterfowl.....	201	3, 213, 658
For other migratory birds and general wildlife.....	24	3, 870, 156
For colonial nongame birds.....	49	91, 043
For big game.....	16	10, 642, 015
Patuxent Research Refuge, Md.....	1	2, 623
Total.....	291	17, 819, 495

TABLE 2.—*Acreage acquired or in process of acquisition for national wildlife refuges under the Migratory Bird Conservation Act and by gift, Executive order and public land order*

State	Refuge	Fiscal year 1946				Acquired in previous years
		Under Migratory Bird Con- servation Act			Acquired other than by purchase	
		Acquired by purchase	Pending title convey- ance	Total		
Arkansas	White River	41		41		106,345
Delaware	Bombay Hook		4	4		13,811
Florida	Anclote				18	155
Do.	Chassahowitzka		2,394	2,394		5,105
Do.	St. Marks	11		11		64,094
Iowa	Union Slough		205	205		1,850
Kentucky	Kentucky Woodlands	220	929	1,149		63,103
Maryland	Blackwater	2,558		2,558		8,025
Minnesota	Tamarac	240	1,568	1,808		29,906
Missouri	Mingo	1,432	18,730	20,162		2,468
Nebraska	Crescent	633		633		43,354
New Jersey	Brigantine		10,282	10,282		2,222
Do.	Killcohook		38	38		867
New Mexico	Bitter Lakes	1,940		1,940		19,324
Do.	Bosque de Apache		85	85		56,027
North Carolina	Mattamuskeet		21	21		50,157
North Dakota	Des Lacs		3	3		14,021
Do.	Lake Ilo		117	117		1,955
Do.	Long Lake	803	1,593	2,396		12,064
Do.	Roosevelt				61,539	
Do.	Tewaukon		512	512		80
Oklahoma	Tishomingo				13,449	
Oregon	Cold Springs		131	131		2,710
Do.	Hart Mountain	5,076	20	5,096		225,762
Do.	Malheur	1,577	30,316	31,893		112,158
Tennessee	Lake Isom	12		12		1,744
Do.	Tennessee				54,365	
Texas	Hagerman				11,429	
Do.	Laguna Atascosa	11,275		11,275		
Do.	Santa Ana	113		113		1,868
Virginia	Chincoteague		143	143		8,809
Washington	Little Pend Oreille	1,831	879	2,710		36,696
Do.	Skagit	1,982		1,982		2,690
Do.	Turnbull		1,006	1,006		11,173
Do.	Willapa	160	3,339	3,499		2,733
Wisconsin	Horicon	215	3,159	3,374		15,023
Do.	Necedah	39		39		39,362
Total		30,158	75,474	105,632	140,800	955,661

*Conservation of Wildlife Resources***Effects of DDT on Wildlife**

The need for detailed information on the effects of DDT on wildlife led, in the spring and summer of 1945, to cooperative studies by the Fish and Wildlife Service and the Bureau of Entomology and Plant Quarantine. The latter Bureau initiated the studies and provided funds for the work; the Fish and Wildlife Service furnished most of the personnel. Other cooperating agencies were the National Audubon Society and the Forest Service of the United States Department of Agriculture. The investigations were conducted in the field and in the laboratory and dealt primarily with the control of forest insects and the effects of DDT on forest wildlife.

Excellent cooperation in evaluating effects of DDT on wildlife has also been received during the year from the United States Public Health Service, through the Carter Memorial Laboratory at Savannah, Ga. Special consideration has been given at the Savannah laboratory to measuring the effects on aquatic life of the use of DDT as a larvicide for control of malaria-carrying mosquitoes. Attention is also being given to effects of repeated applications of DDT on terrestrial animals.

The principal field investigations by the Fish and Wildlife Service to evaluate effects of DDT used as a spray for control of forest insect pests were made in Maryland and Pennsylvania, but observations were also made at localities in other States and in the Province of Ontario.

At the Patuxent Research Refuge in Maryland, population studies in preceding years had laid a sound base for the evaluation of changes in 1945. In Lackawanna County, Pa., the current year's nesting population of birds was determined before DDT was applied. Elsewhere studies were confined to the making of observations from shortly before until shortly after the application of DDT.

Most of the DDT was sprayed by airplane at rates varying between one-fifth and five pounds of DDT, in an oil solution, per acre. However, one pound per acre has been found enough to control many forest insect pests. A single application was the basis for each study. The amount of DDT that reached the vegetation was found to vary considerably, due to difficulty of application and varying density of vegetation.

The results of the investigations indicated that where applications of DDT were at the rate of 2 pounds or less per acre there was no measurable damage to mammals, birds, or amphibians. At five pounds per acre, however, birds and amphibians were killed in considerable numbers and there was evidence that a nesting population of birds was much reduced, probably through reduction in the supply of insect food. In general, invertebrates, fishes, and other cold-blooded vertebrates were more seriously affected than were birds and mammals.

The studies indicated strongly that DDT should be used for the control of insect pests only after weighing the value of such control against the harm likely to be inflicted on beneficial forms. Where used, minimum doses should be applied.

A circular on DDT entitled, "DDT: Its Effect on Fish and Wildlife," was issued during the year.

Nutritional Deficiency in Bobwhite Quail

In wildlife, as in man, nutritional deficiencies often spell the difference between life and death. Studies have been conducted at the Patuxent Research Refuge as a means of exploring and determining the possible importance of nutritional deficiencies in survival of wildlife populations. Several very significant discoveries have been made.

Studies on the vitamin A requirements of the bobwhite quail have established the optimum level of this factor for breeding quail, for growing stocks, and for maintenance in winter. A lack of vitamin A was found to be rapidly fatal both to chicks and adults, while a deficiency of vitamin A in the diet of the breeders affected not only their own survival, and their productivity, but also survival of their offspring. A deficiency in the growth diet affected the growth rate and survival of chicks and their viability during winter; a deficiency in the winter-maintenance diet affected winter survival and subsequent productivity.

This research suggests that not only may a deficiency of vitamin A be responsible for the failure of many restocking programs which utilize pen-reared quail, but also it may be a potent factor in the periodic fluctuation in the population of wild quail and the shrinkage of their natural range.

Two experiments with 944 quail chicks revealed an abnormal feathering caused primarily by a deficiency of riboflavin (vitamin G). A twisted condition occurred in both primary and secondary feathers of the wings, with a corresponding stunting of the tail and body feathers. The incidence was greatest on a diet containing no milk by-products, which are good sources of riboflavin, and diminished as the percentage of milk by-products in the diet was increased. Feathers twisted as severely as were some by these experiments would handicap liberated birds badly in flight and so make them more vulnerable to predation.

Water Utilization and Wildlife

The nationwide movement to develop our rivers in the interest of flood control, irrigation, navigation, and hydroelectric power will radically change the character of our streams and surrounding lands and have a far-reaching effect on fish and wildlife. It is the responsibility of the Fish and

Wildlife Service to protect and enhance fish and wildlife resources; the Service therefore participates in water utilization programs to provide technical analysis and advice in such projects insofar as the provision of tolerable conditions for wildlife is concerned.

Realizing that planning for the fish and wildlife resource must coincide with planning for other purposes, the Service has established a field staff of biologists and hydraulic engineers. These specialists review engineering plans for river development by the Bureau of Reclamation and the United States Corps of Engineers, study the areas involved, evaluate the resources affected by the project, and suggest modifications necessary to mitigate losses and to derive maximum benefits for fish and wildlife. These studies give special consideration to the maintenance of proper water levels in reservoirs and of flows in streams below dams; to preserving adequate spawning, nursery and rearing areas for fish; to correcting pollution; to biological rehabilitation and development of areas for wildlife; and to practical means of protecting fish and wildlife from the hazards of such construction. Reports on projects are submitted by the Service to the Bureau of Reclamation and to the Corps of Engineers for incorporation in their over-all reports.

Many of the contemplated projects will occupy the habitat of some of our most important fish and wildlife species. The river bottomlands, generally speaking, are the areas most prolific of wildlife. For example, migratory waterfowl and numerous species of upland game use the bottomlands especially in the winter season. It is conceivable that a series of reservoirs in a valley could destroy the entire supply of winter cover on which deer and certain game birds depend, and thus eliminate the animals themselves.

Certain projects proposed in the comprehensive plan for the development of the Missouri River Basin will have a major effect on important waterfowl nesting refuges in Montana and the Dakotas. The replacement of nesting habitat eliminated is mandatory for the fulfillment of international treaties and protection of the Federal and State investment.

Our aim is to develop the best methods to utilize the facilities that are being created. Reservoirs are viewed from the standpoint of their future use for the production of sport and commercial fish, as State or Federal migratory waterfowl refuges, and as public shooting grounds. For the highest usefulness of the impoundments in the interest of conservation, the Service is attempting to devise means of increasing fish and wildlife habitat through reasonable and practical modification in the structure and operation of reservoirs. By such modifications, a project may be changed from the debit to the credit side of the evaluation ledger, from the fish and wildlife standpoint.

It is not enough to insure maximum production of fish and game by incorporating sound biological considerations in the development plans; these resources must be managed subsequent to construction and impound-

ment. Only this combination—suitable habitat and good husbandry—will produce and sustain fish and game crops on the land and water types to be created by the national river development program.

Federal Aid to State Projects for the Restoration of Wildlife

The Pittman-Robertson Federal aid to wildlife restoration program has given invaluable aid to the States in their efforts to meet the increasing demands on wildlife resources. Funds for this cooperative restoration work are derived from an excise tax imposed on firearms, shells, and cartridges. The money thus collected is set aside in a special account, known as the "Federal aid to wildlife restoration fund." Each year Congress authorizes the expenditure of a certain portion of this fund, the Federal apportionment being then supplemented by the States, which contributes 25 percent of the cost of each project. All of the States except Nevada, which has not passed required legislation, are eligible to participate in this program. All proposed restoration projects are examined by the Fish and Wildlife Service, which determines whether they are sound in purpose and design before giving the requisite Federal approval.

Sales of hunting licenses during the fiscal year 1945, as compared with the previous year, increased by 9.3 percent. Complete figures for the fiscal year 1946 are not yet available; however, all indications point to a continuation, and indeed an acceleration, of the upward trend. The resulting increase in hunting pressure upon all game resources makes more than ever necessary an intensive restoration and management program.

TABLE 3.—*Status of Federal aid to wildlife restoration fund*

Fiscal year	Amount collected	Amount appropriated
1939.....	\$2, 976, 020	\$1, 000, 000
1940.....	3, 707, 844	1, 500, 000
1941.....	5, 535, 773	2, 500, 000
1942.....	5, 072, 588	2, 750, 000
1943.....	1, 149, 333	1, 250, 000
1944.....	1, 061, 045	1, 000, 000
1945.....	3, 132, 402	900, 000
1946.....	¹ 3, 283, 523	1, 000, 000
Total.....	25, 918, 528	11, 900, 000

¹ Amount collected from July 1, 1945, to April 30, 1946, inclusive.

Projects obligating \$1,191,795.47 were approved during the year. This sum, which is more than the amount appropriated and apportioned for the fiscal year, was available in part from the appropriation for the previous year, and from unexpended balances of completed projects. Projects ap-

proved during the year consisted of 73 research projects, obligating \$490,491.57; 55 development projects, obligating \$333,844.96; 48 land projects, obligating \$262,573.43; and 16 coordination projects, obligating \$104,885.51; or a total of 192 projects obligating \$1,191,795.47.

The amount of \$1,000,000 was appropriated for Federal aid in wild-life restoration for the fiscal year ending June 30, 1946. This was an increase of \$100,000 over the appropriation for the previous year. This appropriation was apportioned as follows:

Alabama	\$12,022.31	New York	\$41,621.30
Arizona	18,549.45	North Carolina	13,015.03
Arkansas	11,195.68	North Dakota	13,010.68
California	39,413.47	Ohio	34,611.62
Colorado	27,381.56	Oklahoma	15,040.22
Connecticut	5,000.00	Oregon	21,374.70
Delaware	5,000.00	Pennsylvania	40,653.78
Florida	11,435.08	Rhode Island	696.50
Georgia	10,806.14	South Carolina	7,457.73
Idaho	19,060.46	South Dakota	16,570.92
Illinois	23,819.32	Tennessee	13,143.78
Indiana	25,209.97	Texas	45,430.19
Iowa	19,219.25	Utah	17,255.33
Kansas	16,904.67	Vermont	4,002.19
Kentucky	9,991.78	Virginia	13,260.67
Louisiana	12,946.09	Washington	26,114.75
Maine	11,443.02	West Virginia	13,453.27
Maryland	5,667.48	Wisconsin	25,154.56
Massachusetts	6,064.46	Wyoming	16,739.84
Michigan	51,201.58		
Minnesota	31,556.68	Apportioned to States	880,000.00
Mississippi	10,473.29	Alaska	12,000.00
Missouri	21,812.29	Hawaii	5,000.00
Montana	27,495.90	Puerto Rico	3,000.00
Nebraska	18,261.25	Deducted for administration	100,000.00
Nevada	*16,915.50		
New Hampshire	5,132.82		
New Jersey	8,075.15	Appropriation	1,000,000.00
New Mexico	19,428.29		

* Set aside pending adoption of qualifying legislation.

The Patuxent Refuge—a Laboratory for Conservation

Programs of investigation in progress at the Patuxent Wildlife Research Refuge in Maryland—of which a large part of the DDT studies and the nutritional work on game birds are examples—have caused this station to become a mecca for visiting scientists from many States and from other parts of the world. Many agencies engaged in conservation work or in activities related to conservation have sent their representatives to consult on special problems and, in some instances, to spend a limited period of time studying procedures and results. Obtaining first hand information on DDT tests or in the use of 1080 has been of major interest to many, but numerous others have come to consult the extensive files at the refuge, to perform specialized phases of wildlife research, or to spend a period of apprenticeship in wildlife work. In particular many States and colleges

have sent young men to the refuge to obtain the benefits of its expert technical guidance, extensive reference collections and other laboratory facilities in analyzing the food habits of wildlife.

Cooperative Wildlife Management Studies

Ten cooperative wildlife research units, financed by State conservation commissions, the land-grant colleges, the American Wildlife Institute and the Fish and Wildlife Service, revived their wildlife research and training programs immediately on the cessation of hostilities. Graduate fellowships were restored and at the end of the fiscal year the units were operating at full capacity.

Alabama.—Projects included studies on bobwhite quail, fox predation, mourning doves, wild turkeys, and white-tailed deer. Publications were Summer Food of Bobwhite Quail and Bobwhites November Menu. An extension project on wildlife conservation and utilization reached 12,000 landowners.

Pennsylvania.—Management studies were made on ruffed grouse in two central Pennsylvania forest types. Increasing wildlife food production by selected tree fertilization in hardwood forests, fall and spring population studies of woodcocks, propagation and nutrition of game birds, improvements in venison cookery, and studies in wild bird homing migration were important activities during the year.

Ohio.—Research projects at this station included work on ring-neck pheasants, cottontail rabbits, pheasant repellents, farm ponds, and determining effectiveness of game management practices on strip mine areas. The chief publication during the year was the cooperatively authored book *The Ring-necked Pheasant and Its Management in North America* in which the major contribution was from the Ohio unit.

Texas.—The most important work done in Texas was on problems of deer and wild turkey management. Other projects included an ecological survey of Big Bend National Park, range use and ecology of the pronghorned antelope and wildlife food production in coastal southeastern Texas.

Iowa.—Important projects continued in Iowa were a study of muskrat populations as affected by quail disease, management in a State land acquisition program, waterfowl and pheasant management studies, experiments in game cookery and white bass investigations on Spirit Lake. Investigations of Iowa foxes were resumed with emphasis transferred to the gray fox.

Maine.—As a result of low muskrat populations for several years, emphasis was given to investigations of that species. Other pre-war projects revived during the year included deer management, and investigations on ruffed grouse, waterfowl and woodcock. The woodcock population studies

were greatly expanded through cooperation of other workers; intensive studies on the black duck and ring-necked duck were initiated.

Oregon.—A 400-page manuscript on the prong-horned antelope has been completed for publication in book form. Projects studied during the year include game management on farm lands, management of blacktail deer, big-game range studies in arid ranges, and ring-necked pheasant management in eastern Oregon. A bulletin on preparation of wild game for food was published.

Utah.—Research projects for the year were biological studies on mule deer, antelope, waterfowl, muskrats on Ogden Bay Refuge, native rabbits, and upland birds, and analysis of annual game kill and fur take.

Missouri.—During the year a comprehensive report on the wild turkey studies was completed for publication, a long-range deer-livestock investigation was initiated in cooperation with the United States Forest Service, and a far-reaching study of wildlife in relation to modern agricultural practices was initiated with the cooperation of several agencies and, notably, a manufacturer of ammunition.

Virginia.—A book on the mammals of Virginia was completed for publication, substantial progress was made on a comprehensive report on Virginia big game, and a State-wide study of farm ponds was initiated.

Wildlife Research on Public Lands

A slight expansion of wildlife investigations on public lands was made during the latter part of the fiscal year through return of four biologists from military furlough to their positions in the States of Washington, California, Minnesota, and Maryland. Nevertheless, inadequate funds and manpower have not made it possible to meet the numerous requests for assistance that are continually received from the various land-management agencies.

The integration of game and forest management, and the relation of rodents to forage production are the two major wildlife problems in the national forests. The maximum combined game-timber productivity of forests can be realized only when the environmental requirements of game are learned and applied and when game officials and sportsmen fully appreciate the necessity and means of keeping game populations well within the carrying capacities of their forested ranges. A survey of national forests in the Southern States indicates that game-carrying capacities there can be increased somewhat by adoption of certain forest management practices not detrimental to timber production.

The relation of rodents to forage and timber production is under investigation in various areas, but since all these investigations deal chiefly with the effect of animal life on plant succession and growth, many years of work are required before conclusive evidence can be obtained.

A wide variety of investigations were made on national park lands, and assistance was given to Indian tribes in the management of their resources of muskrat, beaver, and fish.

In Oregon, an important study was continued on State and private forest lands to learn methods of controlling mice (*Peromyscus*) on areas where reforestation of Douglas fir by direct seeding was in progress. Although the work is not yet complete, the data accumulated so far give great promise that a practicable and economical means of aiding direct seeding of Douglas fir will be developed. The work has great significance throughout the Douglas fir region of the Pacific Northwest, where vast acreages of burned or clear cut land can be economically reforested only if the direct seeding method is perfected.

Fur Farming and Rabbitt Raising

The Fish and Wildlife Service has taken an active part in the restoration of fur farming during the period of readjustment. This activity is an important part of our agricultural development and fits in well with conventional farming.

The most serious effect of the war on fur animal research has been the loss of trained personnel at the various experimental stations and laboratories where such work was carried on. In spite of this handicap, however, the Fur Animal Experiment Station at Saratoga Springs, N. Y.; the Fur Animal Field Station, Cambridge, Md.; the Rabbit Experiment Station, Fontana, Calif.; and other stations where cooperative work is in progress have all made valuable research contributions to fur farmers, rabbit raisers, and fur tradesmen.

On April 30, 1946, the President approved a bill (H. R. 2115) which transferred all functions of the Secretary of the Interior which affect the breeding, raising, producing, marketing, or any other phase of the production or distribution of domestically raised fur-bearing animals or products thereof, to the Secretary of Agriculture, effective July 1, 1946.

Cooperative Control of Predators and Rodents

Active control operations against injurious rodents and predatory animals carried out by the Federal Government in cooperation with States, local governments, and individuals during the year entailed expenditures of \$914,600 from regular departmental appropriations, supplemented by \$935,401 from cooperating States, and \$1,562,471 from cooperating counties, livestock associations, and others. Predatory animals taken during the year under this cooperative program amounted to 117,204, exceeding last year's records by 4,753, and consisted of 108,311 coyotes, 1,557 wolves, 6,487 bobcats and lynxes, 730 bears, and 119 mountain lions. In rodent control operations 11,397,769 acres of infested lands were treated for the

control of prairie dogs, ground squirrels, pocket gophers, jack rabbits, field mice, cotton rats, kangaroo rats, porcupines and woodchucks. In addition, 442,004 premises were treated in cooperative campaigns for the control of common brown and other house rats. Equipment and supplies used in predator and rodent control, and 639,995 pounds of rodent bait materials were distributed to cooperators throughout the country by the supply depot at Pocatello, Idaho.

It is the established policy of the Fish and Wildlife Service to conduct predatory animal control projects for the protection of livestock, poultry, and game in areas where the need is most pressing. The coyote is the chief subject of control because it is responsible for a greater total loss to livestock and poultry than all other predators combined. The world shortage of food which prevailed during the past year emphasized the importance of this cooperative predator and rodent control work. Protection of livestock from destruction by wild predators has provided greater quantities of beef, lamb, pork, and poultry to alleviate world-wide shortages; and the control of rodents has increased the available supply of other food products by reducing damage to crops and destruction of stored food.

The Service continued to render direct aid in conducting rat control work on military and naval installations for the protection of food stores and other strategic supplies.

The practice of encouraging State and local participation in predator and rodent control through cooperative grants of Federal assistance and supervision was continued this year, with the same excellent results that have characterized the work since its initiation 30 years ago. As of June 30, 1946, cooperative agreements were in effect with 29 States and a large number of counties, cities, livestock and farm associations, and individuals. Such agreements were in effect in many eastern States and all States from the Great Plains westward, excepting Kansas, South Dakota, and Utah.

Protection of Livestock and Game

The cooperative control of wild animals that prey upon domestic livestock and game species continued to fall far short of demands for such work, due to insufficient appropriations and personnel. The continuation of low prices for long-haired furs, like coyote, wolf, and fox, resulted in a dearth of private trappers and very little aid from that source. Many hunters supervised by the Service on cooperative control programs have worked with increased diligence in an effort to make up for such impediments.

Increased and improved use of the coyote-getter (a small, set gun containing cyanide) in Texas has been the chief factor in achieving a 45 percent increase in the number of coyotes and wolves taken. Over 35 percent of the total Service and cooperative take of 24,842 wolves and coyotes in Texas during this fiscal year was accounted for by using coyote-getters.

The advantages of this device are its simplicity, requiring a minimum of trained hunters; its adaptability to use on ranges grazed by livestock or game; and its humane effectiveness against coyotes or wolves, especially those that are trapwise. Other States have reported equal or greater success with the coyote-getter.

Protection of Crops and Stored Foods

It is estimated that there may be 130 million rats in the United States, and that the annual loss from food destroyed or damaged by rats and mice amounts to at least \$200,000,000.

The control of rodents destructive to growing crops and stored or processed grains and other food has been more seriously affected by war-time conditions and subsequent slowness of reconversion than has the control of predators. This is because rodent control requires a proportionately greater amount of manpower, which has been a critical factor throughout the year. The situation has been somewhat relieved by the fact that red squill is again being imported and by the greater availability of other poisons. Still greater aid has come from development of techniques which permit more widespread use of powerful new rodenticides, especially sodium fluoroacetate (compound 1080).

It is fortunate that during the present period of inadequate personnel the population of field rodents has been, in general, at a relatively low ebb throughout the country. This has enabled the Service and its cooperators to devote a larger part of the available men and money to the pressing problem of controlling house rats and mice on farms and in cities where food is stored or processed. The magnitude of this job, however, makes it far beyond solution with the limited resources now available.

The huge loss chargeable to rats and mice may be more easily comprehended when expressed in terms of actual individual losses. For example, a wholesale grocery building in Sulphur Springs, Tex., yielded 60 dead rats when treated with compound 1080. Rats had previously destroyed quantities of feed stored in this wholesale house, making it necessary to discard some 4,200 pounds at one time. The owners reported that approximately 5,000 pounds of grain had also been spilled through the floor cracks from sacks cut open by rats.

A wholesale grocery at Lawrenceville, Ga., which was an active backer of the city rat control campaign conducted there, reported recent losses of \$800 worth of flour through cutting and contamination by rats. The monthly losses of various types of produce amounted to approximately \$125 per month.

In controlling rats that are causing damage such as described, the Fish and Wildlife Service has taken the lead by developing compound 1080, and working out methods for the safe use of this highly toxic substance.

The material is too dangerous for use by the general public, but when used by properly trained persons in accordance with recommendations it produces results that are spectacular. Use of this poison at the city dump of Sidney, Mont., yielded 1,110 dead rats the day after the poisoning, 201 on the second day, and 5 the third day. During additional checks no more rats, dead or living, were found. Similar results have been obtained at other city dumps in other States.

One of the most spectacular kills of rats made with 1080 in a water solution was at a New Orleans grain and elevator building known to be heavily infested with rats. The poison was exposed on all floors of the building along rat runs in small cups which held about one-half ounce of the solution. Within the first 24 hours, 3,690 dead rats were picked up. Additional dead rats were found the next 2 days.

Compound 1080 has also proved effective against infestations of field rodents which it is difficult or costly to eliminate by other methods. Numerous spot infestations of prairie dogs, particularly in Texas, Arizona, Utah, Colorado, and New Mexico, have been cleaned up by using this new poison in grain bait that is dyed a brilliant yellow to discourage birds from eating it. Rodents, being color blind, eat the dyed grain without hesitation. There was no apparent effect upon bird life in the areas treated. This method of preventing damage to birds, recently developed in the Denver Wildlife Research Laboratory of the Service, is now being used to an increasing degree in rodent-poisoning operations.

Field mice are reported on the increase in the Atlantic States and in central Utah, doing extensive damage to orchards and garden crops. Compound 1080 has proved effective against these rodents. Rice and cotton rats have continued to require control in the Southern States, chiefly in South Carolina and Florida, on both truck farms and sugarcane fields. Because of manpower difficulties, control of porcupines has been possible in only a few areas.

The need for ground squirrel control has been slight, populations of these animals now being at a low point in the cycle of abundance over much of their range.

Accompanying the generally low cycle of rodent populations, there is a noticeable scarcity of jack rabbits throughout nearly all of their range. In North Carolina and Nebraska the Service assisted orchardists and others by using a recently developed rabbit repellent known as 96-A. Results have been good there as well as in the northern plains, where the repellent has proved beneficial on shelter belt and orchard trees.

Conservation of Inland Fishery Resources

On the whole, the inland game fisheries of the United States were not adversely affected by the war. To a great extent the moderate drain on fresh-water fisheries was linked with the rationing of gasoline and tires, which

prevented anglers from traveling any great distance to fish. Waters near metropolitan areas were heavily fished and in some sections the stock of fish was reduced to a certain extent. In other waters where the fishing pressure was less the stock was rebuilt somewhat. On the other hand, limited manpower and other facilities made it impossible to carry on a large scale program for the development of the inland fisheries.

Artificial Propagation

Despite wartime difficulties—insufficient operating personnel, shortages of proper fish foods for trout and salmon and of pond fertilizers for warm water fish—the fish-cultural program as a whole held up very well. Production of several species dropped slightly, but some of the important forms, like chinook and silver salmons, and brook and brown trouts, showed an increase.

During the calendar year 1945, Service hatcheries produced a total of 5.5 billion fish and eggs (table 4).

TABLE 4.—*Summary, by groups, of the output of fishes and eggs during the calendar year ended Dec. 31, 1945*

Group	Eggs	Fry	Fingerlings or larger	Total
Catfishes.....			681,445	681,445
Blue catfish.....			150	150
Channel catfish.....		110,000	137,355	247,355
Buffalofish.....	75,000,000		102,000	75,102,000
Shad.....		21,370,000		21,370,000
Whitefish.....		700,000		700,000
Lake herring.....		2,250,000		2,250,000
Striped bass.....		279,000		279,000
Atlantic salmon.....			90,835	90,835
Chinook salmon.....	4,528,480	10,507,140	27,533,380	42,569,000
Chum salmon.....		2,452,200	80,000	2,532,200
Silver salmon.....	88,420	915,600	1,600,110	2,604,130
Sockeye salmon.....	354,670		1,662,395	2,017,065
Landlocked sockeye salmon.....	156,690		85,650	242,340
Landlocked salmon.....			61,770	61,770
Steelhead trout.....	180,740		207,625	388,365
Rainbow trout.....	11,117,950	643,380	8,890,995	20,652,325
Cut-throat trout.....	14,761,840	3,680,870	2,827,450	21,260,160
Loch Leven or brown trout.....	1,296,660	74,100	2,476,660	3,847,420
Lake trout.....	5,000	179,600	1,155,615	1,340,215
Brook trout.....	14,020,800	410,670	5,389,770	19,821,240
Grayling.....	1,709,740		3,450	1,713,190
Northern pike.....	14,110,000	920,000	2,160	15,032,160
Crappie.....			1,106,330	1,106,330
Largemouth black bass.....		428,620	5,727,560	9,156,180
Smallmouth black bass.....		894,000	159,805	1,053,905
Rock bass.....			54,610	54,610
Warmouth bass.....			5,140	5,140
Bluegill sunfish.....		153,000	12,400,760	12,553,760
Red-eared sunfish.....			1,638,070	1,638,070
Rio Grande perch.....			30	30
Pike-perch.....	300,000	29,425,000	275,500	30,000,500
Yellow perch.....	308,000	1,540,000	56,050	1,904,050
White perch.....		1,035,000		1,035,000
White bass.....			480	480
Cod.....	1,981,366,800	206,615,600		2,187,982,400
Haddock.....	153,000,000			153,000,000
Flounder.....		1,721,295,400		1,721,295,400
Pollock.....	904,051,200	191,826,900		1,095,878,100
Lobster.....		2,988,000	103,435	3,089,435
Terrapin.....	130		12,000	12,130
Grand total.....	3,176,357,120	2,203,672,180	74,528,585	5,454,557,885

To meet the needs of modern conditions, the trout-propagation program in Federal hatcheries is undergoing some modification. Under intensive hook and line fishing, which is extending more and more to the isolated areas, it has been found that neither natural reproduction nor the planting of small fish is adequate to maintain the stock and support good fishing. Legal-sized trout are needed to maintain the stock in heavily fished areas. The most economical time to plant these fish is in the spring and during the open fishing season. Although most of the trout-cultural programs over the country are now pointed toward a policy of this kind, hatcheries as a rule are ill fitted to support this modern program, having been designed for the production of fry or fingerling stages. Propagating trout to legal size requires large quantities of fresh meat and other foods, more space, and a better trained and larger staff to cope with problems attendant upon the longer growing period for the fish and their confinement to limited hatchery space.

During the early part of the war the Service undertook to insure good fishing for men located in Army camps and rehabilitation centers by stocking suitable waters on or adjacent to Army, Navy, and Veterans' Administration areas. In a number of instances this program was carried on co-operatively with State conservation departments. During the year approximately one-half million fish, many of legal-size, were provided for stocking these waters. A number of the wounded men fished from wheel chairs when they were able to do little else. This recreation was conducted as a part of reconditioning training, and according to the reports of officers in charge, recovery and return to normal status was materially hastened for hundreds of men by this outdoor sport.

During the year research directed toward the improvement of fish-cultural techniques and practices was actively prosecuted. Activities along this line included: biological control over production at the fish-cultural stations associated with the Grand Coulee and Shasta Dams; nutritional and pathological investigations pertaining to salmon and trout culture; and general studies of certain proposed water development projects in the Columbia Basin to determine how artificial propagation can be most effectively employed, where indicated, to mitigate adverse effects of the projects upon the food-and-game-fish resources.

Several devices and procedures developed during the year have increased the efficiency of fish culture. For example, two types of mechanical "feeders" were developed for feeding fingerling fish in large rearing ponds with less wastage of food and with a reduction of approximately 80 percent in the labor involved; practical methods were developed for enumerating salmon eggs and fingerlings, assuring greater accuracy with no additional effort; several new disinfectants were tested and show great promise for controlling diseases among hatchery fish; and a program of nutritional re-

search leading to the development of cheaper, nutritionally adequate diets for salmon fingerlings, was initiated.

During the year the study of the effects of various chemicals on *Bacterium salmonicida*, causative organism in the trout disease, furunculosis, has been an important activity. Of the several drugs tried, sulfamerazine proved the most effective.

Because of the extensively developed use of liver in human nutrition the quantity available for fish-hatchery use has become extremely limited, and the price prohibitive. The Service is making fundamental studies of fish nutrition to find suitable low-cost substitutes and to determine the exact nutritional requirements of fish. As an example, the nutrition laboratory of the Service maintained at Cortland, N. Y., in cooperation with Cornell University has just completed a report on the utilization of carbohydrates by fish.

Farm Ponds

During recent years the economic value of farm ponds has been thoroughly proved. It has been found that these small ponds, usually 1 to 5 acres in area, will produce 200 to 300 pounds of edible fish per acre annually, especially in the South, if they are properly fertilized and fished.

The stocking of multiple purpose farm ponds with fish from Federal hatcheries reached a new peak during the calendar year 1945. During this period 7.6 million fish were furnished to stock farm ponds, an increase over 1944 of more than 90 percent. Farm ponds created under the auspices of the Soil Conservation Service received 4.9 million fish. Many of the remaining fish were planted in ponds sponsored by the Agricultural Extension Service and the Agricultural Adjustment Agency. In connection with the stocking of farm ponds, the Fish and Wildlife Service made 13,276 individual plantings during the year. These represented only a portion of the total ponds stocked since many areas were planted with fish from State hatcheries. Most of the fish planted in farm ponds were warm-water species, with large-mouth black bass and bluegill sunfish the most popular forms.

Hatcheries which are supplying fish for farm pond applications have now reached almost their maximum production. Some slight increases might be effected by better management of the ponds, additional use of fertilizers, and careful planning of the disposition of the product. The relation of farm ponds to soil-conservation activities and to the conservation of wildlife has been well established. As soon as equipment becomes available, additional contractors are expected to enter the field of pond construction, and demands for fish will be materially greater than at present. These anticipated demands can be met only by additional personnel and

by modernization of existing stations and the construction of new units in selected localities.

Dams Versus Fish Populations

The development of rivers for power, irrigation, and navigation poses endless problems in fishery conservation. To preserve even the minimum life requirements of fish populations in streams undergoing vast modern engineering developments demands long study and careful planning by biologists and engineers. But such planning is only the initial step which must be followed by continuous management of the fisheries affected if the value of these resources is to be preserved for the public. Details of the management program will vary from one situation to another, but may require major salvage operations, as on the Columbia River, and will usually embrace a program of artificial propagation.

The year brought fresh confirmation of the success of the most ambitious management program of this type ever undertaken—the transfer of all the salmon runs blocked by Grand Coulee Dam to new spawning tributaries downstream from the dam.

For the second consecutive year since the relocation activities were terminated, the fish were allowed to pass upstream unhindered. Only a few strays proceeded upstream to Grand Coulee Dam, the vast majority turning off and entering the tributaries to which the runs had been relocated. Notwithstanding some inevitable losses as a result of relocation, there appears no question that the major portion of the fish have been successfully transplanted to the tributaries below Grand Coulee Dam. On the Sacramento River, where a similar problem exists, the salvage program was continued, and observations indicate that the plan of providing for spawning in the main river has been successful. Such spawning has been made possible chiefly through the withdrawal of cool water from the lower levels of the reservoir.

Fundamental research is being carried on in several river systems on problems that occur widely. An example of such generally applicable research is the determination of the mortality of the downstream fingerlings when passing large main-stem dams. This is being studied at Bonneville Dam, where fingerling traps and fyke nets are being operated to determine the seasonal, horizontal, and vertical distribution of the downstream migrants. Methods of diverting the migrants away from actually or potentially dangerous passages and into safe channels of migration are being sought. Since every dam creates an impoundment and for that reason markedly changes the environmental conditions in the stream area, an intensive study of the effect of impoundments, insofar as fish life is concerned, has been inaugurated. Biological and physical data are being obtained

at a number of reservoirs in order to make possible an estimate of the probable effect on the fish life that will result from the construction of any of the proposed dams.

Virtually all of the tributaries of the Columbia River used by anadromous fish for spawning and rearing areas have been surveyed in previous years; others were studied during the past year. The tributaries in the lower reaches of the Columbia River have particular importance, since this area must assume the burden of maintaining production for the entire river as the construction of additional main-stem dams destroys the upper river runs.

An experimental relocation of upper Columbia River spring chinook and blueback salmon to a hatchery in the lower river has been attempted. If successful, the progeny will be studied over succeeding generations to determine the effect, if any, of the greatly reduced distance covered in the spawning migration upon the physiological characteristics of these runs.

Pollution and the Fisheries

Water pollution in the United States causes tremendous losses of natural resources. The Fish and Wildlife Service is concerned with the problem as it affects fish life in lakes and streams, fish and shellfish in coastal waters, fisheries in the offshore waters, and wildlife.

A major effort has been made during the past year to determine the pollution hazards to fish and other aquatic organisms created by new effluents and by various new chemicals developed during the war for use as insecticides and plant-killing agents. These studies have been directed not only toward the determination of the critical and immediately lethal effects of the substances, but also to the determination of the action of these materials and effluents, when in high dilution, on the various components of water favorable to fish life and on the fish themselves. Numerous cases of specific pollution have been surveyed and evaluated in response to particular requests, and new methods for the study of water quality problems and stream pollution have been developed.

Conservation of Marine Fishery Resources

More than 95 percent of the total quantity of fish and other aquatic products landed by our fishermen is derived from the oceans surrounding the coasts of the United States and Alaska. The study of these great sea fisheries is therefore one of the most important and necessary activities of the biologists of the Fish and Wildlife Service. Although the Federal Government has actual power to regulate the fisheries only in Alaska, its recommendations, based on the findings of its biologists, are freely made available to the State conservation agencies to guide them in the protection and development of these resources.

Between 1941 and 1945, many long term biological studies were unavoidably interrupted or greatly reduced in scope through the contingencies of war. The past year has been a period of reconversion, many of the fishery biologists being still largely occupied with wartime assignments, and with reviewing and resuming biological research projects. Considering the difficulty of restoring depleted personnel and obtaining funds for resumption of full-time biological research, the progress made by the end of the year can be considered encouraging.

North Atlantic Fisheries

Studies in the North Atlantic area were concentrated on the fisheries for haddock, lobster, flounders, rosefish, and Atlantic salmon.

The decline in the productivity of the haddock fishery on Georges Bank, center of the present fishery, has been linked to the failure of the years 1941 through 1943 to make important additions to the population through spawning. This failure to maintain the population has been revealed by an analysis of the changing size and age composition of the catch. Study of the distribution of haddock on the fishing grounds and of the total production of all species of groundfish provides a hint of the underlying cause of these spawning failures: Competition for food, coupled with an actual decline in the food-producing capacity of the bottom. Whether any season since 1943 has provided a large brood of haddock to relieve the situation is not yet known, several years being required for the young fish to reach commercial size.

The catch of yellowtail flounders, now one of the most important of the North Atlantic fishes, declined so sharply in 1945 that the catch-per-day was less than one half that made three years earlier. Biological studies indicate that this decline in the catch is linked with an actual decrease in the stocks of this species.

In Maine, center of the lobster fishery, the catch of this valuable crustacean rose from about 7½ million pounds in 1940 to nearly 18 million pounds in 1945, following a long period of low productivity by this resource. The Service has conducted an investigation designed to evaluate the causes of this increase in the catch. Rearing and stocking operations apparently could account for less than 1 percent of the increase, while the increase in the size limit in 1942 could account for not more than 10 to 20 percent. Preliminary conclusions indicate that the balance of the increase resulted from favorable levels of spawning and competing stocks. Studies of these factors, however, are only partially completed.

Salmon restoration studies were continued, including experiments to determine the best season and age to stock hatchery-reared young, experimental stocking of Pacific silver salmon, and limited Atlantic salmon

restoration experiments. A preliminary survey of Connecticut River dams, power developments and tributaries, was made in connection with fishway recommendations, and experiments were started on fishways and on a new type of fish weir for holding small salmon.

Studies of the rosefish, which for several years has supported New England's largest fishery, show that the average daily catch per boat on the New England banks is declining in spite of improved fishing methods, and that the average size of the fish is decreasing. Both changes signify a decrease in the stocks. As further warning that this species requires careful management, preliminary analysis of the age and growth rates from scales and length measurements indicates that it is very slow growing. Growth of immature fish may be less than one inch a year, and maturity may not be reached until 10 to 12 years of age.

Middle Atlantic Fisheries

Fishery research in the Middle Atlantic States was confined to (1) the shad: continued observations to determine whether the shad fishery is remaining at its recent high level of abundance in the Hudson River: determination of causes of decline in other rivers, and the formulation of practical methods for the rehabilitation of the fishery in the Delaware region; analysis of the effectiveness of a recently introduced management plan for the Chesapeake Bay; (2) blue crab: study of the fishery of Chesapeake Bay to determine the causes of sharp fluctuations in production (analyses to date indicate that they result more from natural environmental conditions than from the effects of fishing intensity); and (3) shore fishes like sea bass, summer flounder, and striped bass which comprise an important segment of the fishery by commercial and sports fishermen in the Middle Atlantic area.

Great Lakes Fisheries

Reports were completed during the past year on the whitefish fishery of Lakes Huron and Michigan, on the 1942-43 mortality of smelt in Lakes Huron and Michigan, and on the distribution, spawning, age and growth of the kiyi (one of the "whitefish chubs") in Lake Michigan.

Work has been continued or initiated on the distribution and growth of the longjaw (another "whitefish chub") in Lake Michigan; the relationship between soil erosion as a source of turbidity and silt deposits and the abundance of Great Lakes fish, especially in Lake Erie; the yellow pike fishery and the growth and artificial propagation of the yellow pike in Saginaw Bay, the biology of the lake trout in Lakes Michigan and Superior; and analysis of fishery statistics to show regional fluctuations in abundance and in fishing intensity.

Pacific Coast Fisheries

Investigations of the Pacific pilchard resource during the year were on a curtailed basis under which it was possible only to analyze catch records and ages of fish in samples of the catch, upon which to base estimates of abundance and replenishment of the stock. During the closing months of the year, in cooperation with the pilchard fishing industry, an observer was at sea collecting data on sea conditions and incidence of pilchard schools. His observations emphasize the changeability of sea conditions and also the severe limitations on research at sea when conducted from boats which are engaged primarily on other tasks and which lack the trained navigating personnel and the special equipment needed to assay the important qualities of the sea water on the fishing grounds.

Investigations of pink salmon at the Little Port Walter biological station were continued throughout the year for the purpose of determining fresh water survival of the young salmon, the return of adult salmon to the spawning grounds, and the correlation between weather and temperature conditions and rates of survival and time of downstream migration. Operations at the station this year were unique in that all seaward migrant pink salmon were captured and marked before being allowed to continue their migration to the sea. The percentage of fresh-water survival this year was only 0.8 percent, considerably below the average for the past 6 years, and attributable largely to adverse temperature conditions prevailing in the stream during the incubation period.

Studies of the valuable Alaska red salmon were continued, principally in the Karluk River system and in Bristol Bay. The Alaska salmon industry has taken steps to intensify biological research in Bristol Bay and in southeastern Alaska through establishment of a well-financed research staff. The industry program will be carried on in cooperation with the Service to avoid duplication of effort and facilitate interchange of information and findings.

Increased abundance of herring in some areas in Alaska have made possible increased catch quotas. Mortality studies and other biological investigations of the species have been the basis of predications of abundance upon which the quotas are determined in advance of fishing seasons.

Management of Shellfisheries

In oyster studies made in close cooperation with the Maryland department of tidewater fisheries, the Service has continued its investigations of the biological and ecological conditions on the principal public reefs in the Maryland part of the Chesapeake Bay. These studies have included the composition of the oyster population, growth, time of spawning and setting, and environmental factors concerned in the management of public reefs. From the data obtained, a program of State management has been recommended and is being followed with the result that increased oyster production seems assured.

Current advice was given to the industry engaged in the private cultivation of oysters in New England, by the distribution of bulletins on the progress of oyster spawning and setting, on the prevalence of oyster enemies, and on the better handling of oysters in their cultivation. Studies were made of feeding and growth and the effects of environmental changes on the physiology of oysters, particularly the effect of salinity changes, an element of extreme importance to those engaged in oyster production in the Gulf of Mexico.

Preliminary plantings of three different types of seed oysters at the co-operative experimental and demonstration oyster farm on North River have yielded marketable oysters of fine quality and size on barren bottom areas, many thousand acres of which are available in North Carolina for the cultivation of this shellfish.

The parasites of oysters were studied to determine their distribution and the extent of damage they inflict, as well as to obtain information leading to the application of adequate control methods. A microscopic parasite of the oyster, *Nematopsis ostrearum*, which may cause paralysis of the shell muscle, is transmitted to healthy oysters by small mud crabs. Control of this parasite by the destruction of the mud crabs on public and private oyster beds is being studied.

Extensive pollution of coastal waters with industrial wastes and sewage constitutes a serious problem of the oyster industry. Bacteriological studies on the trend of domestic-sewage pollution and its spread in the Hampton Roads area of Chesapeake Bay have been continued. These studies, which are of great importance in showing the need of sewage purification, reveal the extent of sewage pollution in that area before purification projects, planned to be completed in the near future, begin operation. Later studies will show the effectiveness of the purification plants and the importance of sewage treatment in increasing the grounds available for the growing of marketable oysters.

In connection with problems of pollution, studies were completed on the action of chlorine on oysters and the effects of sulfate pulp-mill wastes. Investigational work on the effects of DDT on the oyster industry was undertaken.

The biological laboratory operating a terrapin hatchery at Beaufort, N. C., produced, during the fall of 1945, a total of 12,770 diamond backs providing a supply of 11,370 young for distribution in five National Wildlife Refuges and other coastal areas from Virginia to Georgia.

Conservation of Alaska Fishery Resources

Managing the Commercial Fisheries

In Alaska the Federal Government, through the Fish and Wildlife Service, exercises direct jurisdiction over the fisheries. To assure a continuation of high yields from this most valuable of Alaska's natural resources, and at the

same time to guard against excessive exploitation, vigilant control is necessary.

The value of the contribution of the Alaska fisheries to the recent war effort is emphasized by the fact that 80 percent of the salmon pack for 1945 originally was earmarked by the Government for military needs. This quota was reduced substantially, however, as the season progressed and the favorable turn of the war reduced food requirements for military purposes.

The fishing industry was again handicapped by shortages of materials and manpower, although in 1945 the lack was less critical than in other recent war years. For the third successive season, operations of the salmon cannery were concentrated under a program sponsored by the Office of the Coordinator of Fisheries, permitting a more efficient use of available labor and equipment. But in some areas disappointing runs of salmon resulted in one of the smallest packs in recent years. Herring, on the other hand, continued to increase in abundance in the principal producing areas, making possible a liberalization of the catch quota for this species. The condition of other Alaska fishery resources, with few exceptions, was good.

Revised regulations for the protection of the commercial fisheries were issued by the Secretary of the Interior on March 27, to be effective in the 1945 season. The regulations provided for an increase in the herring catch quota, but restricted commercial salmon operations in Bristol Bay, the most important red salmon area, to about 50 percent of normal capacity. This curtailment was necessary to provide additional protection for the weak cyclical run which occurs there in the years divisible by five.

The Director of the Fish and Wildlife Service spent a number of weeks in the Territory giving personal attention to problems of fishery management. Seasonal opening and closing dates, areas open to fishing, and gear restrictions, were adjusted to permit additional catches where circumstances warranted.

Fishery patrol facilities including 11 patrol boats, 7 speedboats, 14 launches, and 4 open boats were used for protecting the fisheries. Vessel patrol activities were supplemented effectively by Government-owned and chartered airplanes. Personnel engaged in Alaska fishery protective work numbered 125, including fishery management agents, stream guards, weir operators, vessel crews, wildlife agents, and airplane pilots who assisted in this work.

Periodically, throughout the season, surveys were made to determine the extent and condition of the salmon runs and to assemble other information as a basis for modifying the regulations. Weirs for counting the escapement of spawning salmon and obtaining biological data were operated in six representative streams.

The Fur-Seal Resources

The Pribilof Islands fur-seal herd, which comprises 80 percent of all the fur-seals in the world, is managed by the Fish and Wildlife Service for the profit of the American public. Since 1910, when Federal control of this resource was assumed, seal skins and other products have brought into the Federal treasury more than 8 million dollars.

The annual census of the fur-seal population, taken in August 1945, showed that the herd contained 3,155,268 animals, an increase of 7.11 percent over the preceding year. In 1900, there were only about 17,000 animals in the herd. The 1945 season produced 76,964 fur-seal skins and in the winter season of 1945-46 the fox take—which is incidental to sealing—aggregated 1,296 blue and white skins.

The Alaska fur-seal herd has been affected very little by the war, although it was necessary, for military reasons, to suspend operations on the Pribilof Islands in 1942. The wisdom of the management program administered by the Fish and Wildlife Service is evident in the continued growth of the herd and the upward trend in the number of fur-seal skins taken each year, as shown by the following table:

Year	Sealskins obtained	Animals in herd	Year	Sealskins obtained	Animals in herd
1930.....	42,500	1,045,101	1938.....	58,364	1,872,438
1931.....	49,524	1,127,082	1939.....	60,473	2,020,774
1932.....	49,336	1,219,961	1940.....	65,263	2,185,136
1933.....	54,550	1,318,568	1941.....	95,013	2,338,312
1934.....	53,470	1,430,418	1942.....	150	2,585,397
1935.....	57,296	1,550,913	1943.....	117,164	2,720,780
1936.....	52,446	1,689,743	1944.....	47,652	2,945,663
1937.....	55,180	1,839,119	1945.....	76,964	3,155,268

The growth in the size of the fur-seal herd in recent years, and the increasing scope of sealing operations at the Pribilof Islands present management problems of immediate concern. These include the determination of the optimum size of the herd, the relation of the fur-seal herd to the commercial fisheries, variations in mortality rates, and studies of migration routes at sea. Another problem has to do with replacing and enlarging plant facilities on the Pribilof Islands to keep pace with the growth of the herd.

With the end of the war, plans are being made to resume biological investigations to provide, among other things, an index to the number of surplus animals to be killed each year; also information will be developed that will be generally applicable to the conservation of the fur-seals of the North Pacific.

Utilization of Fishery Resources

Promotion of the greatest possible utilization of our aquatic resources is a direct means of conservation, for the more completely the catch of fish

and shellfish can be utilized, the less will be the required drain on the resource to satisfy our needs. The Fish and Wildlife Service is therefore concerned with promoting full utilization by the conduct of statistical, technological, marketing, economic, and educational research and services.

Statistics on Production and Marketing

To meet the needs of the fishery industry for current information on market conditions, the Fish and Wildlife Service issues daily releases on production, stocks, prices, movement, and general market conditions. This information is collected and published by eight Fishery Market News Service Offices, strategically located in important production and consuming centers over the country. The addition of two new offices during the past year makes possible coverage on a Nation-wide basis. Utilization of these daily reports by the various sections of the fishing industry has been greater during the past year than at any time since this service was initiated.

This daily market information is augmented by publication of the results of monthly and annual statistical surveys, planned to assist the fishery industry in efficient and economic operation. Such surveys include data on employment, yield by species of both raw and manufactured products, gear operated throughout the United States and Alaska, prices of fishery commodities, and detailed data on quantities of fish frozen and held in cold storage.

Because of the great interest in the production of fish meal and oil, both of which have continued to be in short supply, a monthly report on the yield of these important products was added to the regularly published bulletins.

Publication of the Service's annual digest, "Fishery Statistics of the United States," was resumed during the year when the 1942 edition was sent to the printer. Shortages of personnel and funds had made it impossible to publish this report during the war.

Sanitation in Fish Processing Plants

Fish is one of the most difficult of food products to handle from the standpoint of sanitation in processing plants. Elimination of flies and other vermin being the first requisite of sanitation, the Service has thoroughly explored the adaptability of some of the newer insecticides for use in food processing plants. During the summer of 1945 an intensive sanitation campaign was waged against the common house fly, using residual sprays of the insecticide DDT in and around processing plants. A specific request was received from the industry at Crisfield, Md., for assistance in eliminating flies in the fish and crab meat processing plants of that city. This operation was undertaken with the assistance of the Bureau of Entomology and Plant Quarantine of the United States Department of

Agriculture. Not only were the processing plants sprayed, but instructions were furnished to the entire population of the city for handling the spray, equipment, and material, with the result that home owners and merchants in the city cooperated in the program. About 10 days after the completion of this treatment a spot survey indicated a reduction of approximately 98 percent in the fly population. Methods of applying this insecticide were demonstrated in processing plants and wholesale and retail establishments in New York City and Boston. These services and other sanitation and quality studies will be continued next year.

Research on Containers for Fishery Products

Since the earliest attempts to freeze fish and hold it in cold storage, the industry has experienced difficulty in preventing evaporation of moisture and loss of quality by dehydration. This difficulty is the result of qualities of composition and structure inherent in the flesh of fish. In an effort to discover a suitable container for frozen fish, Service technologists have investigated many treatments and wrapping materials without finding one that is entirely satisfactory. Some of the war-developed plastics are now being investigated to determine their effectiveness as protective coverings for frozen fishery products.

Transportation by air requires special methods of packaging and refrigeration for such perishable products as fresh fish, live lobsters and crabs, and various shellfish. Since air shipments of seafoods is a new venture, still in the experimental stage, little knowledge of the requirements of these products was available, and it has been necessary to make a large number of tests of the various types of containers. These studies are progressing satisfactorily; some recommendations have already been made to manufacturers of containers as well as to air transportation companies.

Research on Sources of Vitamin A Oils

During the early months of 1945 landings of soupfin shark livers declined to a point insufficient to maintain the high production of vitamin A liver oils necessary for civilian as well as Government demands. Research designed to reveal supplementary sources revealed significant facts about the grayfish or dogfish, a small shark long known to yield vitamin-A-bearing oils. The size or age of the grayfish was found to have a definite bearing upon the quantity and quality of the vitamin A oil contained in the liver. On the basis of these findings it was recommended to the industry that no grayfish under 30 inches in length be taken, since it is not only uneconomical to process the livers from smaller dogfish but wasteful from the standpoint of conservation. These recommendations were accepted.

Economic Research and Services

In order to promote the efficient functioning of the fishing industry as an integral part of the whole economic system of the United States, the Fish and Wildlife Service employs a staff of economists to make basic studies of such matters as employment and labor problems in the fisheries, price structure of the industry, and organization of cooperatives. Results of these surveys are published for the information of the industry. Included in the economic surveys made during the past year were the following: (1) Study of the purposes, financial structure, legal basis, and effects of cooperatives on the Pacific coast (2) surveys on State unemployment laws and compensation rates as they relate to fishermen and allied workers (3) analysis of the effect of strikes and other work stoppages on the economic conditions of the industry (4) studies of marketing agreements, subsidies, price-support programs, and parity prices in connection with their possible application to the fisheries (5) production and distribution costs on salmon, pilchard, mackerel, tuna, and shark fishing on the Pacific coast.

Development of Markets

The beginning of the postwar period found the fishing industry in an anomalous position. On the one hand it was unable to produce enough canned fish to meet demands; on the other its production of fresh and frozen fish had reached an unprecedentedly high level. Added to domestic supplies were increasingly large imports. This difficult situation could be met only by creation of wider markets. To assist in normalizing the marketing situation, the Service prepared market development bulletins and articles in trade publications, arranged demonstrations of fish cookery, worked with operators and patrons of refrigerated locker plants, and cooperated with the Department of Agriculture in releases to the press and radio.

Educational Services

During the closing months of the year, the framework of a fishery educational service was established in readiness for an extensive program to be launched during the fiscal year 1947. Such a program is indispensable to the future welfare of the American fisheries. If this industry is to compete successfully with other food industries and is to meet increasing foreign competition, it must have access to the most advanced knowledge of better fishing methods, improved processing, shipping, and distributing techniques, and adequate facilities for training personnel. The fisheries of many foreign nations have had the benefit of such services and are today producing fishery products whose high quality enables them to bid for world markets.

The National Park Service

By NEWTON B. DRURY, *Director*



AS MILLIONS of Americans, freed of wartime controls on travel, poured back into the national parks and monuments during the past year, they had the satisfaction of knowing that the National Park System had remained essentially the same as before the war. The virgin forests still stand; the scenic canyons have neither been blocked nor obliterated; the lofty mountainsides remain unscarred by mining. The great and cherished places of nature and of human history still present what is best and most inspiring of the American scene.

With the return of peace we believe that there are few who would contend that the parks should have been sacrificed, or materially altered except as a last resort. We know that there are many who are profoundly grateful that the war did not bring us to such extremity, and that the resources of the parks have been kept intact in the face of demands for their utilization for war. It is gratifying to record again the fine understanding of park values that so many officers of the Army and Navy and other war agencies possessed, and their willingness, and genuine desire, to turn to other fields for critical materials and lands whenever it could be shown that the needs of a Nation at war could thus be met.

This first year of postwar operations in the National Park System has involved a process of reconversion and of resumption of normal activities and responsibilities that proved fully as difficult and vexatious as was anticipated when the lifting of travel restrictions last August set millions on the road. Travel returned immediately—and somewhat surprisingly, considering the general condition of automobiles and tires—to normal and higher-than-normal volume. The process of adjustment to it, however, was slowed by an insufficiency of personnel, both in the National Park Service and concessions; by the deterioration of both the Government's and the concessioners' facilities; and by the serious shortage of equipment. Reduced to hardly more than a custodial basis during the war, with many regular functions either greatly curtailed or entirely eliminated, the field organizations—those charged with on-the-ground management of the parks and monuments—have made an effort to meet the demands made upon them that deserves full recognition.

1946 greatest travel year.—The floodgates of travel opened immediately after VJ-day. For months thereafter all previous monthly records for numbers of visitors were broken; parks whose remoteness had rendered them inaccessible to all but a handful of visitors during the war were suddenly hosts to great crowds for which neither the park staffs nor the concessioners were prepared. Nor was it possible, in many instances, to make adequate preparation for many months thereafter.

Travel figures for the National Park Service are based upon a travel year which extends from October 1 to September 30 of the following year. It is anticipated, on the basis of the number of visitors thus far, that the 1941 record of 21,050,426 will at least be equalled and probably will be surpassed. During the fiscal year which ended on June 30, attendance at all areas in the system was 16,086,947.

In general, visitors understood the difficulties under which both the Service and the concessioners were endeavoring to care for them, and most of them accepted cheerfully the inconveniences of a period of reconversion. There were complaints, of course, but the number was infinitesimal in comparison with the millions who were happy to have an opportunity once again to visit the national parks.

Personnel insufficient.—When the ebb of wartime travel turned to the flood last August, the roll of regular employees of the Service contained approximately 1,575 names. During a fall and early winter period which saw all previous attendance records broken, both personnel ceilings and lack of funds prevented any material increase in that number. A measure of relief was obtained when a supplemental appropriation of \$357,650 became available on January 1. This permitted the Service to restore former employees to the rolls as they were discharged from the armed forces or were released by other war agencies or industries, though it did not meet adequately the needs which arose so suddenly with the coming of peace. By June 30, there were 1,795 permanent employees on the regular rolls, and to these had been added 1,524 temporary employees.

The total number of employees paid out of funds directly appropriated to the National Park Service on the latter date was approximately the same as were on the rolls during the 1941 season. It would be natural to infer from this that employment had returned fully to normal. That was very far from being the case, however, for two very important reasons.

During the 8 years that preceded the war, virtually all of the ordinary maintenance work in many of the major areas of the park system, including that required for the many new facilities made possible by Civilian Conservation Corps and other emergency construction agencies, was performed by CCC enrollees, under the direction of CCC foremen. It would be extremely difficult to estimate what this assistance amounted to annually, but several thousand enrollees and supervisory personnel were thus occupied. Today, all the maintenance work they formerly performed is thrown back upon the regular forces.

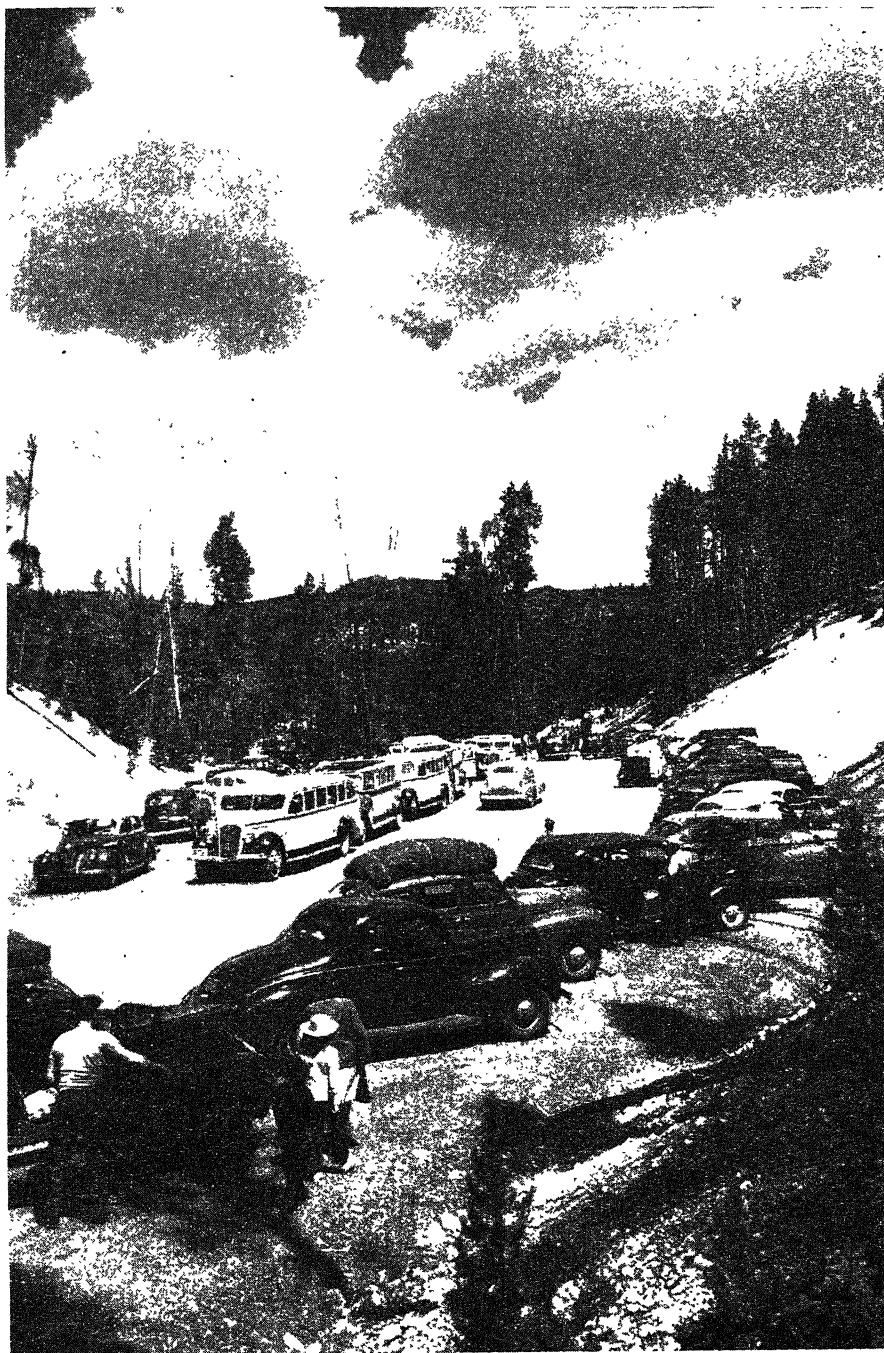


FIGURE 6.

And these forces themselves were materially reduced, in effect, by the establishment of the standard 40-hour week for all Federal employees. Employees in the parks formerly worked a 48-hour week, so that this change was approximately equivalent to a decrease of one-sixth in their number, not to mention the other complications which have resulted from its application to operations which, for most areas, are in full swing 7 days a week through much or all of the year.

Many employees have loyally and voluntarily worked much more than the prescribed 40 hours per week without extra compensation. They saw that certain work had to be done, both to serve the visitor and to supply needed protection to the public properties for which they were responsible.

Concession Service Rendered Under Difficulties

The unprecedented wave of travel to the national parks following the war created a host of problems for the concessioners who contract to operate visitors' facilities. Their operations had been drastically curtailed and in many instances entirely discontinued during the war, particularly the hotels and transportation service. Reconversion to peacetime operations involves repairs and improvements the need for which has accumulated over 5 years and which still lags through insufficient supplies of materials, labor, busses, food, and needed specialized equipment. One great handicap in attempting to resume service on a prewar basis has been the lack of experienced personnel. The 5-year break in normal operations, plus war service of many employees, drained off the efficient personnel that had returned annually to form the nucleus of the summer operating staffs, and provided for no training of replacements. Considerable confusion inevitably resulted from the employment of inexperienced help. Under these conditions, the park concessioners acquitted themselves very well, and the visitors were sympathetic with their difficulties.

As happened in the great majority of hotels throughout the country, park concessioners were flooded with requests for advance reservations that far exceeded any peacetime experience. With untrained people handling reservations there were at times unavoidable lapses in service. Although there were some complaints, the number was small in comparison to the total volume of work handled. In one of the most widely-visited western parks, 10 new employees took over the reservations work that formerly had been handled by 2 experienced clerks and yet were unable to keep the volume current. As additional housing could be opened and manned, it supplemented in midseason and fall the various wartime accommodations, and bus service was resumed with such equipment as had not been transferred to war-connected industries. Admittedly, facilities and services to the public during 1945-46 were not—and could not be—up to the usual park standards.

Record registrations and applications for hotel and lodge accommodations made it necessary in the national parks, as in most of the hotels throughout the country, to limit the stay of guests at some parks in order to provide accommodations for the greatest possible number of visitors. No uniform stay limitations were imposed because of the varying conditions existing in different areas. In those parks having the heaviest concentration of travel, as at the South Rim of the Grand Canyon where the requests for reservations far exceeded the accommodations available, stays at hotels and lodges were limited to three days, no exceptions being made even for persons who annually made advance reservations covering periods ranging from a month to the entire summer. Much of the travel in the fall and winter was composed of members of the armed forces who were still taking the opportunity to visit national parks as leave and travel conditions permitted; and the concessioner and Service officials alike made maximum efforts to care for these visitors.

Facilities returned by the military.—All concession facilities used by the armed forces during the war, including the Ahwahnee Hotel in Yosemite National Park, the Arlington and Majestic Bath Houses in Hot Springs National Park, and Frijoles Lodge in Bandelier National Monument, were returned to the concessioners for civilian use. Rehabilitation of the Ahwahnee Hotel, which had been remodeled and refurnished when it became a naval convalescent hospital, had not been completed by the end of the fiscal year.

Rates.—Some increases in costs to the public were made early in the year to offset the price of labor and food supplies. Approval of new rates by the National Park Service was subject to the regulations of the Office of Price Administration. In arriving at the schedules to be submitted for the 1946 season, one major park concessioner last fall planned on increases above the 1941 levels of approximately 40 to 50 percent in salaries and wages of employees, the latter largely of the temporary type. The law of supply and demand entered the picture, however; and when the season opened this operator found it necessary to pay approximately 90 to 150 percent higher wages to his new and inexperienced hotel and lodge employees than he had in 1941. Rates in the parks have not kept pace with rising costs, and in general they compare favorably with those of like outside enterprises.

Wage and hour studies.—A proposed revision in the wage and hour regulations for concessioner employees has been studied, and recommendations on new regulations will be submitted for the approval of the Secretary at an early date. The regulations, among other things, will provide for a Board of Labor Review to pass on the basis of employment of all concessioner employees.

The Western Conference of National Park Concessioners met in Chicago on December 3 and 4, 1945, with many members of the Director's staff

attending certain of the meetings. Among the topics discussed were return to full prewar operations, wage and hour regulations, extension of the operating seasons in the parks, winter operations, the possibility of overstimulation of travel as a result of advertising, and the apparent need to limit length of stay at hotels and lodges.

National Park Concessions, Inc.—This nonprofit distributing corporation continued to furnish concession facilities at Mammoth Cave (Ky.), Isle Royale (Mich.), and Olympic (Wash.), National Parks. It initiated operations in Big Bend National Park in Texas, in accordance with previous arrangements, and prepared to reopen facilities on the Blue Ridge Parkway which had been discontinued because of the war.

A review of the concession policy.—Some phases of the concession policies and practices of the National Park Service were sharply criticized by the Interior subcommittee of the House of Representatives Appropriations Committee when the 1947 Interior Department appropriation bill was reported to the House, after having been the major subject of discussion during the preceding hearings. This criticism was given considerable newspaper publicity, including the comment of at least one syndicated columnist. It has led to careful analysis by the Service of concession practices. Because the Service believes that this criticism was the result of insufficient knowledge of the "how and why" of national park concessions, and the difficult problems involved, there is justification for including in this report the significant facts as to the origins of the concession system and the conditions under which concessions must be operated.

At the outset, these facts need to be borne in mind:

The Federal Government, except in few instances, does not own the buildings and other public accommodation facilities in national park areas. The Congress has never given approval to a general policy of Government ownership of these facilities though many members favor it.

That being the case, it has been necessary to enlist private capital to provide accommodations. Authorization for this procedure was contained in the earliest national park act—that which established Yellowstone National Park in 1872.

Owners of private capital, generally speaking, have erected the buildings, furnished transportation equipment and provided the organization necessary to care for the public staying in the parks. Some have sought this business opportunity; others have been induced to undertake it. In either case, they have not invested their money in these provisions for the public in the parks without a reasonable expectation of fair earnings and the ultimate amortization of their investment.

Existing law forbids concession contracts exceeding 20 years in duration. Since the useful life of such substantial structures as the concessioners are expected to provide is normally more than 20 years, and since Internal Revenue regulations in many cases preclude writing off the investment in this period, this limitation, instead of being for too long a period, as is

sometimes claimed, is in reality too short from the standpoint of the investors of private capital on these Federal lands. It compels either an unreasonably high allowance for depreciation, which usually cannot be allowed, or an implied understanding either that the concession contract will be renewed at the end of the 20-year period or that the Government will give the concessioner an opportunity to recover the remaining value of his investment when the contract expires.

If the Government were to acquire the facilities which are normally operated through concessioners, operation, through concession contracts, would have to be on one or the other of two bases. One would be that it should produce a sufficient return to the Government to meet reasonable interest charges and to amortize the investment during the expected life of the structures. The other would be consciously to permit a lower return and the absorption by the Government of some portion, at least, of this investment, because of the social benefits accruing to the public as a whole, with operation at something less than the cost of rendering the service. In other words, a subsidy. Since only a small percentage of the whole public actually utilizes the facilities, it is doubtful if an adequate case could be made for the second course. In general, it would seem logical that rates for special services such as hotel accommodation, meals, and transportation, even if the plant were Government-owned, should be set at levels calculated to amortize the investment in facilities within the period of their useful life, and afford the operating agencies reasonable compensation for their services.

Operation of concessions in the National Park System has not always resulted in profits to the stockholders. The average return of all concessions in the past 7 years has been under 3 percent. Even in the case of those which have operated at a greater profit, that profit, in most cases, could hardly be considered more than a fair return on the investment, considering the hazards of the business.

For national park concessions operate under a number of serious difficulties and handicaps which are by no means common to similar or related undertakings elsewhere. These justify classifying the investments involved as highly speculative. All are subject to heavy seasonal fluctuations in volume of business; some have periods of less than 2 months of operation at approximate capacity, though burdened with heavy carrying charges throughout the year. Most of them are distant from sources of supply of such things as foods, most building materials, and competent help. Many can maintain only a nucleus organization during the greater part of the year and are compelled to recruit most of their employees seasonally. They are, furthermore, closely regulated by the Government with respect to rates, service, management, and construction of facilities, and are often compelled, in the public interest, to carry on certain lines of unprofitable business. And while the private enterpriser outside of the parks can determine the amount of any kind of accommodation he may wish to supply, the

park concessioner is compelled to be ready to meet with reasonable adequacy the needs of the public on all but the peak-load periods of the season, such as the Fourth of July holiday and the Labor Day week end. All of these factors materially affect the cost of concession operations, their rates, and their attractiveness to private capital.

However, the Federal Government, recognizing its responsibility to meet the basic needs, comfort and convenience of visitors has adopted the only course open to it—the recruitment of private capital on terms that would attract such investment. The National Park Service has long contended that the facilities required to meet this responsibility, if they are to be established within the parks, should be in Federal ownership. The existence of a private vested interest, even though temporary, is basically undesirable, even though it has congressional sanction of long standing. Federal ownership, coupled with actual operation by a competent and carefully chosen concessioner, should make it possible to provide needed services more cheaply. Money costs the Federal Government less, insurance would be unnecessary, and depreciation allowances (made for cost calculations only) could be accurately related to the expected life of structures. Government ownership would have the further advantage of wider latitude in selection of desirable operators than is possible when a considerable private investment has to be taken into account.

Only in a small minority of instances are the concession facilities now in Federal ownership, and in only one of these, Mammoth Cave National Park, can the operation be considered of major importance. At present, housing, meals, transportation, retail stores and other services are furnished in the various areas of the system under 85 concession contracts. The investment of several of the concessioners amounts to several millions of dollars. Developments placed on park lands by private capital have cost more than \$29,000,000. With them, a necessary and useful function has been performed, and the companies performing them have, with rare exceptions, been animated by the desire to serve the public well and fairly. If we were to start over “from scratch,” some kinds of facilities that now exist would not be reestablished; others would be placed in different locations; but, on the whole, the concessioners have met a real need, which could not have been met otherwise, and have done it well.

With the approval of the Secretary of the Interior, plans have been made to appoint a committee of experts to make an early and dispassionate study and appraisal of national park concession procedure, and to formulate recommendations for its improvement.

Background of park concession policy.—Concessions, and the need for them, extend back far beyond the establishment of the National Park Service 30 years ago. They go back, indeed, to the beginnings of national park history. The Congress, unwilling in those earliest years even to provide for park maintenance and protection, included in the Organic Act of March 1,

1872, establishing Yellowstone National Park, a provision authorizing the Secretary of the Interior in his discretion to "grant leases for building purposes for terms not exceeding ten years, of small parcels of ground, at such places in said park as shall require the erection of buildings for the accomodation of visitors * * *." Ten years proved too short a period to enable private companies to install the proper types of accommodations and furnish regular service with any assurance of a fair return upon their investment. The result was a chaotic situation, as hotel competed against hotel and agents of various transportation companies hounded prospective passengers. Park visitors were the sufferers from the mismanaged and competing concession operations. While on vacation the average American neither likes to be besieged by representatives of various caterers to his comfort nor to take time to shop around on the ground to secure the lowest rates.

To insure greater stability of investment and operation, the Congress in 1907 amended previous authority to permit the issuance of concession leases for periods not to exceed 20 years. Later acts, including that creating the National Park Service, carried a similar provision.

Even before the establishment of the National Park Service, when the late Franklin K. Lane appointed Stephen T. Mather (later to become first Director of the National Park Service) as Assistant to the Secretary, in charge of national parks, the concession problem came in for critical analysis. Mr. Mather worked unceasingly to improve concession service through the making of more favorable contracts, elimination of undesirable services, enforcing contract provisions more consistently than had been possible previously, and studying types and locations of accommodations. His successors, Horace M. Albright and Arno B. Cammerer, likewise devoted much time and thought to the concessions system, realizing its importance in assuring public enjoyment of the parks.

It was not always easy to interest private capital in establishing adequate, dependable tourist facilities. In several instances, Mr. Mather appealed to businessmen in communities near certain parks to develop necessary accommodations as a matter of civic pride, in the face of dubious prospects of profit.

A particularly troublesome concession problem has been that of transportation. In at least two major national parks, Mount Rainier and Rocky Mountain, competition threatened an impossible situation in the early days of the National Park Service. "Jitney" operators of one type or another demanded the right to transport visitors from railheads to hotels. However, the park concessioner, operating under franchise from the Federal Government, was compelled to furnish service during the operating season, whatever the weather, for one passenger or a carload. Dependable regular service was guaranteed by this contract with the Government. On the other hand, the irresponsible operator of jitney service made hauls in

good weather and at times of peakloads, thus depriving the concessioner of an opportunity to make a profit to offset the losses sustained when travel was at low ebb. The unlicensed competitors sought to take the cream of the business, but with no guarantee of service.

Every effort has been made to solve this problem fairly and in the public interest. Years of experiment and experience had proved the impossibility of assuring satisfactory service under conditions of unregulated competition. The alternative which seemed most likely to produce adequate facilities and service for the visitor and to attract concessioners willing and able to assume continuous responsibility for such service was one under which at each area a single well-financed operator provided each type of service, and sometimes several types, under conditions and at rates regulated by the Government. This policy, now of many years standing, has resulted in a degree of reliability of service that appears to have justified it.

Start toward Government ownership of facilities.—A beginning in Government ownership of concession facilities was made in the middle 30's, when it became possible to construct several small concession units with funds and labor contributed through emergency construction programs. These were owned by the Government, but operated by private concessioners.

The most significant development along this line, however, came in 1941, with the formation of a private nonprofit distributing corporation known as National Park Concessions, Inc., to operate the hotel and other facilities for visitors at Mammoth Cave National Park. The physical properties had come into the possession of the United States when they and the lands upon which they are located were donated to the Federal Government for national park purposes.

Another nonprofit distributing organization, Government Services, Inc., has also become interested in the operation of federally owned national park concession properties. A strong organization that has been in existence for more than a quarter of a century, it operates cafeterias, newstands, and similar services for Federal workers in Government buildings in Washington, D. C. Well-financed, it is in a position to branch out into other fields.

This type of operation has thus far proved satisfactory from the standpoint both of the public and of the National Park Services. It remains to be seen whether in the larger enterprises it will prove as satisfactory as have been the operations by experienced private concessioners.

Beset by the increased difficulties that surround any operations involving labor, food, and materials under present conditions, and aware of the Department's avowed long-term policy of Government ownership of all fixed assets within the parks, some of the larger and older concessions have indicated a willingness to sell their equity. During the war, one concession corporation offered its facilities for sale at a price of around \$2,000,000.

Unfortunately, no Federal funds could be obtained to buy the properties outright; nor were the nonprofit distributing organizations which were interested in acquiring and operating the concession able to arrange the necessary loan. Negotiations are again under way to obtain a loan for this purpose, with the full support of the National Park Service.

Visitors to national parks are there as guests of the Federal Government. It is the obligation of the Government to see that they are properly treated, get the service they are entitled to, enjoy themselves, and are not overcharged. Until the Government will make the basic investment, the National Park Service hopes to select concessioners that are amply financed to install the facilities, are able to conduct the business in a sound manner, will work closely with the National Park Service, and have sympathy for and understanding of its policies and its obligation to serve the public.

The Problems of Winter Use

Many national parks are unusually beautiful in their winter mantle of snow and ice. A winter visit is a rare experience. Winter sports are exhilarating alike to participant and spectator. The National Park Service is deeply interested in encouraging as much use as possible that does not involve injury to the parks or undesirable commercial or promotional aspects.

Use of most of the parks was curtailed during the war more drastically in winter than at other seasons of the year, since war-caused shortages of funds, personnel and equipment, affecting both the Service and the concessioner, made operation even more difficult than in normal times.

The Service has been devoting special effort to the development of sound winter-use policies. Conferences with members of ski and other outdoor organizations have been a part of that effort, and careful consideration has been given to all their suggestions and their criticisms of the Service's policies. Secretary Krug has indicated that, as funds and facilities become available, the parks should provide wider opportunities for winter enjoyment.

Accommodations.—Among the factors foremost in determining the extent of winter use is that of accommodations. At parks like Crater Lake, Mount Rainier, Lassen, Yosemite, and Sequoia, the majority of the winter sports enthusiasts are in the parks only during the daytime. But there is growing pressure for overnight accommodations and meals, particularly over the week ends. This presents serious financial and operation problems. Cabins suitable for summer have proved inadequate and dangerous, if at all usable, in winter, partly because of the impossibility of heating them adequately and partly because they are not safe under the heavy snows in the high mountain areas. Paradise Inn, at Mount Rainier—long a winter-sports mecca—is a building of several stories, yet frequently it is all but covered by drifting snows which at times have reached the ridge of the

building at the gable end, a depth of 60 feet. Caring for the public is costly and difficult under such conditions. It is highly hazardous to house large numbers of guests in winter in a timber building covered with snow and having few exits. Buildings for winter use should be fireproof and strong enough to stand the heaviest snow loads.

In addition to the heavier fire hazard under winter conditions, the problem of heating is an abnormal one. Even during the summer the hotels in the more northerly parks require heating. To maintain warmth in winter at such altitudes means heavy fuel costs and substantial construction.

All these facts make it obvious that providing sleeping accommodations in the national parks is much more costly in winter than in summer.

In winter, the problem of peakloads, serious enough at other seasons, is intensified because nearly all patronage is concentrated on weekends and holidays, yet it is necessary to keep up operations throughout the week, and every week. Experience has shown that, in some parks, to require the concessioner to maintain the normal standard of public service during the winter means reduction in earnings to a point where the concessioner might well decide to withdraw. The Rainier National Park Co., for example, furnished winter accommodations at Paradise Valley for a number of years, but always at a loss. Largely as a result of this service, the company has been fairly consistently in the red on its annual operations. Inherent in any operations there, under the weekend peakload that prevails, is the difficulty of obtaining dependable or sufficient employees when needed, without a heavy pay roll during the remainder of the week with little or no patronage. At Mount Rainier and elsewhere attempt is being made to work out a practical method of furnishing overnight accommodations to the greatest extent justified by conditions.

Parks never closed.—No national park is officially closed during the winter, in the sense that gates are barred or visitors prohibited from entering. The seasonal dates, frequently called the opening and closing dates of the national parks, refer only to the operating season when concession accommodations are fully available. Such closing as does occur is the result of heavy snows that block access roads or entrance to certain high mountain areas. Even those most difficult of access, however, are as available to the modern traveler as they were to those of earlier days. But for the modern traveler living accommodations and roads in these wilderness areas appear to have become necessities.

Needed for increased winter use is a larger permanent staff of rangers. Protection of visitors and rescue and first-aid work, including not infrequent need to take out the victims of skiing and other accidents on rescue toboggans, is a heavy responsibility resting upon the National Park Service when it invites the public to use the parks in winter.

Use during past winter.—Before the war, skiing and other winter sports were exceedingly popular in the mountainous areas, particularly in

Yosemite, Mount Rainier, Sequoia, Rocky Mountain, Crater Lake and Lassen Volcanic National Parks. The only national park able to function fully on a winter basis in 1945-46 was Yosemite. During two war winters, when the Service was without funds to open the road to the famous Badger Pass ski area, the public benefited from the fact that the Navy Department financed the clearing of this road for the benefit of convalescents at the naval hospital then maintained in the park. Last winter skiing hit an all-time high in Yosemite, with 81,770 visitors at Badger Pass, as compared with 74,000 in 1940-41. During the season from December to April inclusive, 105,832 persons entered the park.

Much of last year's criticism of the Service's winter use policy was caused by the fact that at the beginning of the winter season, the road to Paradise Valley in Mount Rainier National Park was not opened. It could not be, as the National Park Service was still operating on a war-time budget and the Congress had not yet provided funds for snow removal. Heavy snowfall closed the road to Paradise about November 15. A fund of \$11,500 carried in a supplemental appropriation, made it possible to undertake work in midwinter to reopen it. By that time the snow was hard-packed, so that dynamiting was necessary on the upper sections; and progress was slowed by stormy weather and heavy snows. The road was opened to traffic on March 3. In no other park, however, were extra funds provided for snow removal until July 1, 1946.

Danger of slides.—Snowslides are an ever-present element of danger in connection with the Paradise Valley winter sport center. As the road climbs to the Valley, cars pass through towering snowbanks. Behind these banks is the weight of snows on the steep slopes above them, always potential sources of devastating slides. Thus far, no serious accident has arisen from this cause; but the public should know that park staff and visitors alike are in some danger every time they drive between the deep walls of snow and the Service must take this into calculation in planning winter use there.

The demand for winter-use areas at Rocky Mountain National Park was much heavier last winter than before the war. Skiing facilities there have been of the simplest types, designed for daytime use only. New interest in the extension of winter activities in the park and in nearby communities has resulted in studies by communities and civic organizations to find areas suitable for winter development, including overnight accommodations. Similar studies are to be made in Olympic National Park.

Sequoia National Park, and the Grant Grove section of Kings Canyon National Park, had all-year use prior to the war. The closing of accommodations for visitors has restricted such use during recent years, but it is expected that winter facilities will be available again during the coming snow season.

Crater Lake has splendid scenic and recreational attractions both summer and winter and excellent possibilities for snow sports. Last spring a plan was announced to establish park headquarters near the south en-

trance, at a lower elevation than the present headquarters. This is a logical step in the development of Crater Lake into an all-year park. During the war years, and last year, it had to be closed during the winter, since snow removal there is an especially costly item.

Yellowstone National Park has never been an important winter-sport center, because of location and weather conditions, but it provided a thrilling wildlife spectacle in pre-war years along its Cooke City Road and elsewhere. Guided wildlife trips in winter should be resumed as soon as funds and conditions permit.

Developments being planned.—The Service is interested in encouraging informal skiing, snowshoeing, ice skating and tobogganing in which all, skilled or unskilled, may participate if they so desire. This use should be on the same basis as summer use—noncommercial, suitable to the areas in which made available, involving no undue disfiguration of important landscapes, and appealing to active, vigorous outdoor people who particularly enjoy indulgence in winter sports in places of scenic beauty.

Development of adequate winter facilities is being planned for all parks where conditions justify it. This is no simple task; it will require a high degree of cooperation by all those concerned, and a sympathetic understanding of the many and serious difficulties involved. The subject has been treated at some length in order to promote that understanding.

Since funds for snow clearance will be available during the coming winter, day use can be assured in most of the areas of heavy snowfall. The provision of overnight accommodation remains the still-unsolved problem in several of them, however. Concessioners cannot be expected to operate for long at a loss. Nor should summer visitors be expected to pay rates high enough to compensate for winter deficits. Thus while winter accommodations are no problem where experience has shown them to be profitable, they can be furnished in others only if the individuals or groups who use them are willing and able to pay rates which can cover the higher costs of winter operation or if it is decided that the Government should meet a part of the extra costs ordinarily borne by the concessioner. The later course might be followed if the Government were to provide light and heat, water and sanitary service, and perhaps some form of maintenance of the buildings used for overnight accommodations. Such a program would require enabling legislation. The extent to which it should be done is a matter of policy for the Secretary of the Interior, the Bureau of the Budget, and the Congress to decide.

Private Lands Still a Major Handicap

At the close of 1946, the critical problem, or group of problems, posed by the presence of more than 600,000 acres of non-Federal lands within the boundaries of national park system areas remained unsolved. The request for a modest \$350,000, recommended by the National Park Service

and approved by the Bureau of the Budget, which would have permitted the service to begin a land acquisition program, was disapproved by the Appropriations Committee of the House. Pleas for its inclusion by the Senate committee were no more successful. The unwillingness of these committees to authorize any land purchase funds except the \$30,000 needed for the Montezuma Well property in Arizona, is largely explainable by the opposition of western members of Congress to the removal of further lands from the tax rolls. This fact emphasizes the disadvantage under which the Service labors, by comparison with other Federal agencies which are permitted to return a portion of their income for the support of local units of government.

The large amount of non-Federal land inside the national parks and monuments over which the National Park Service has no control is a constant threat to the integrity of these areas and a serious impediment, in many cases, to sound development and economical, effective administration. It has been emphasized in the past, but deserves restatement, that delay in starting a regular, orderly program of acquiring these lands involves, at best, ultimate large increases in cost, both because of increased land prices and because of the expensive developments being placed upon them. At worst, it means that scenic and historic resources that should be preserved are destroyed or are so modified as to lose the character that gives them park value. In either event, the people of the United States are the permanent losers.

It is now estimated that between \$1,250,000 and \$1,500,000 annually for a period of as much as 20 years will be required to eliminate the non-Federal lands in the national park system. Meanwhile, every effort is being exerted to effect exchanges, where those are feasible, to accomplish a part of this needed program. Legislation which authorized exchanges with respect to non-Federal lands in Glacier National Park was passed during the closing days of the Seventy-ninth Congress, after the end of the fiscal year. The extent to which this authorization will prove useful is still problematical.

Protection Presents Varied Problems

Placing an area in the National Park System does not result automatically and inevitably in the complete preservation and protection of its natural and historical resources. The desire to log virgin timber or to utilize minerals, forage, and water does not die when these resources are embraced within park or monument boundaries. Periodically the cry about "locked-up resources" is raised by interested parties. Undesirable encroachments appear where too little land is included in a park or monument. Historic or prehistoric structures deteriorate if funds are inadequate for repair or stabilization or for employment of a sufficient protection staff. Endeavors in a few instances to give permanence to avowedly temporary military uses

have presented an additional problem. Even the normal and legitimate use of areas, particularly when concentrated and continuous, in such places as public camp grounds, has a progressively destructive effect on plant life and on the soil itself.

The need of lumber for veteran housing was the reason given for the most recent effort to have a portion of Olympic National Park returned to National Forest status, so that some of its virgin forest might be logged. When the park was dedicated in June, Secretary Krug declared that Congress had decided that matter in establishing the park; that any change in the decision would also rest with Congress; but that any recommendations of the Department would be based upon national rather than local considerations.

"I am convinced," he declared, "that such forest as that which gives Olympic National Park such outstanding distinction must be preserved, if future generations of America are to have the privilege of savoring fully and deeply its wilderness grandeur."

Mining interests oppose the proposal to eliminate from Joshua Tree National Monument minerially valuable lands amounting to approximately one-third of its present area, and which the Department has approved. Instead, they want all but 50,000 acres of this extraordinary desert area to be opened to mineral exploitation.

With the ending of the war, pressure for the wholesale invasion of the western parks and monuments to graze livestock has greatly decreased, though stockmen and their organizations continue to favor the use of much more park and monument land for this purpose. Meantime, existing grazing, covered by lifetime permits to those who had the grazing privilege in a number of areas at the time they were added to the park system, is being reduced very slowly. During 1945 it amounted to 101,315 animal months, a decrease of 5,704 from the previous grazing season. In several areas, notably Saguaro and Organ Pipe Cactus National Monuments, grazing is proving very damaging to desert vegetation; at Saguaro, in fact, the giant cacti are almost bound to disappear if the practice continues, since it has prevented any new growth, while the necrosis which has attacked the mature plants is steadily destroying them.

The enforced deferment of the Service's ruins stabilization work during the war offered a serious threat to the Nation's heritage of antiquities in the Southwest. As a result, the ancient Tumacacori Mission in Arizona has begun to show alarming signs of structural failure. Prehistoric cliff dwellings, pueblos and other pre-Columbian Indian structures require immediate attention by skilled stabilizers. Fortunately there are excellent prospects that emergency work can soon be undertaken with funds for rehabilitation and repair approved in the 1947 appropriation.

The difficulty, or the impossibility, of maintaining historic scenes against undesirable encroachments, where Federal land ownership is seriously in-

adequate, is well exemplified at Fredericksburg Battlefield, where so much of the area consists of drives which traverse narrow strips of park land.

Logging operations now in progress along Lee Drive will denude of timber all private property along the drive. The development of suburban subdivisions near the drive, at the base of Lee Hill, and adjoining park lands on the Chancellorsville battlefield, will inevitably detract from the historic interest of those portions of the park. Similar encroachments by developments not consonant with the historic scene are in progress on the borders of both Gettysburg and Vicksburg National Military Parks.

Although National Park System areas are involved only in a few instances, the Service and the Department have a legitimate concern over the possible effects of river basin developments, including the construction of huge dams and the impounding of great bodies of water, upon historic and prehistoric sites in the areas inundated. These threaten the loss of priceless materials unless the impoundments can be preceded by thorough reconnaissance and by the careful removal of the materials so revealed. Eighty percent of the major archeological sites of the country lie in river valleys; the Missouri and its main tributaries are considered by anthropologists to possess extraordinary importance in the study of early man on the North American continent.

A cooperative agreement between the National Park Service and the Smithsonian Institution placed upon the latter the responsibility for excavation of selected sites and thus the saving of further scientific evidence from permanent loss; and the allotment of funds from the Bureau of Reclamation and the Corps of Engineers has permitted a start on this work. Three field parties in June were assigned by the Smithsonian Institution to make reconnaissance surveys in the Missouri Valley, and arrangement for a start on studies in other river basins was being made. Such surveys will be useless, however, unless they can be followed by a large-scale excavation program in each major dam construction area.

An important step in foreseeing preventable damage by reclamation works was taken this spring, when Secretary Krug approved a memorandum of agreement between the National Park Service and the Bureau of Reclamation which provides for full consultation by the Bureau with the Service in advance of the detailed planning of any reclamation projects which would in any way affect the areas within the National Park System.

To the request of the War Department for the permanent use of lands on the Chickamauga Battlefield, for which temporary use had been granted during the war, Secretary Krug returned a vigorous denial.

"Each of the military parks is the last possible debt payment of the Nation to a portion of our soldier dead," he asserted, "and I should be unwilling to agree to the permanent dismemberment of any of these areas except in case of dire national need."

Secretary Krug continued efforts to effect a solution of the Virginia Peninsula traffic problem. The Virginia Highway Department, as well as individuals and organizations in the Hampton Roads region, advocate the construction between Yorktown and Gloucester Point of a high-level suspension bridge which will permit the passage of naval vessels of any class. The Service and the Department have opposed this proposal for several years, and with the cooperation of the Public Roads Administration, have endeavored to obtain favorable consideration of a crossing higher up the river. The massive suspension bridge, if constructed, would tower higher than the Yorktown Victory Monument and would overshadow the battlefield on which American independence was finally and conclusively won and the village in which the Federal Government has striven, at considerable expense, to retain a colonial atmosphere.

Of the effects of human use—complicated by that of animals, in this case—Superintendent White of Sequoia-Kings Canyon National Parks has this to say:

Nature will not restore the over-used areas where men trample and deer and rodents eat all natural growth. Either we replant or we fail at our job of conservation in these parks. To replant we must have a nursery and the personnel to run it * * * We should frankly face the need of setting aside more and larger areas for public use. This is also necessary so that we can rotate the use of campgrounds and other over-used places.

Protection against forest fires effective.—The fire suppression record of the National Park Service continues to be one in which the Department takes pride. More than 9,500,000 acres of forest, woodland and grassland require intensive protection. Yet only 40 out of a total of 335 forest and grass fires in 1945 were allowed to exceed 10 acres in extent. The total burned area was only 4,991 acres, slightly more than half of 1 percent of the area protected. Although the slim organization of fire-control personnel was necessarily composed largely of teen-agers, continuing training and drill made this record possible.

The value of "smoke-jumpers" in suppressing forest fires in remote areas was conclusively demonstrated in Glacier National Park, where crews were parachuted to and suppressed seven potentially dangerous fires, at a time when all available ground forces were engaged on other more accessible blazes. Provision has been made for expansion of this service, which involves close cooperation with the Forest Service in training and utilization.

During 1945, employment of a Civilian Public Service crew at Mount Rainier National Park made possible a start on reducing the serious fire hazard which was created by the presence of countless snags left by former fires. Funds are available for carrying the program forward into the next season.

Prison sentences of 5 years each, meted out to two men convicted of wilfully starting forest fires in Great Smoky Mountains National Park, seem

to have had a deterrent effect, as no further incendiary fires have been reported from the park. The convictions resulted from FBI cooperation.

The use of an orthodichlorobenzene and oil penetrating spray on an epidemic attack of Engelmann spruce beetle, which threatened to wipe out the forest fringe around Cedar Breaks National Monument, and on a less extensive mountain pine beetle attack in Rocky Mountain National Park was successful in both cases. Though control measures for outbreaks of the beetle in Grand Teton National Park are under way, the epidemic spread of attacks outside the park, if unchecked, may nullify the effective work of previous years. In Great Smoky Mountains National Park, experimental use of penetrating sprays to combat the southern pine beetle have been successful, and plans have been laid to combat several outbreaks of this insect. There has been effective maintenance control of endemic bark beetle attacks in Mount Rainier and Yosemite. Periodic control work over the years has lessened the over-all damage caused by insects and, in general, park forests are in excellent condition.

White pine blister rust, now entrenched in the northeast and northwest and spreading southward, is the most serious tree disease threatening park and monument forests. The control program, though slowed by the war, continues to progress. Of 450,136 acres in the Service's control program, 241,100 acres have been worked over at least once and 163,071 acres are considered to be on a maintenance basis.

Periodic spraying of the beech in Acadia National Park for control of the European beech scale has proved effective in preventing the inroads of the beech bark disease, which threatens to wipe out much of the beech in the northeast. The control system has been systematized and it is hoped by this means to preserve for posterity a sample of the widespread beech stands which elsewhere seem threatened with extinction.

System areas are sanctuaries for wildlife.—The national parks and monuments are sanctuaries for more than 65,000 hoofed animals and for unestimated thousands of carnivores or flesh-eaters. A list of the bird species undoubtedly would include most of those known to inhabit the United States and its territorial possessions. There are vast numbers of less conspicuous creatures.

Settlement of the American continent has wrought far-reaching changes in the homes of most species. For those mammals and birds which are unable to adjust themselves to close proximity of man or to man-caused changes of environment, the wilderness areas of the national parks and larger national monuments have been all-important to survival. This is true of such species as the grizzly bear, the wolf, the fisher, and the trumpeter swan. Other species, which definitely are endangered and for which various units of the National Park System serve as important retreats, are bighorn, marten, otter, kit fox, cougar, and lynx. The list will be further enlarged, whenever the Everglades National Park is established, to include the Ever-

glades and swallow-tailed kites, Florida crane, roseate spoonbill, the manatee, and the American crocodile. Some of the species named above would probably have become extinct if it were not for the type of protection afforded by national parks.

Basic management policies.—The animal life of the parks serves its highest purpose as a living representation of the original American fauna. Instead of serving as food, fur, or trophies for a few, the wildlife is “utilized,” without being consumed, by millions of Americans who come to the parks to observe, photograph, and study. Predators are protected together with their prey, as a part of a balanced wildlife community. This exhibit of the entire fauna in natural surroundings affords science an unparalleled opportunity for research and the public a unique field for observation and enjoyment.

One of the greatest contributions of national parks to wildlife conservation may be demonstrated in the coming air age, which will render most of the remaining roadless areas accessible by planes, and will bring them within easy travel range of many more millions of people, including hunters. Legally, the parks remain the only inviolable areas where wilderness sanctuaries stand a chance of being held.

Future offers management problems.—The purpose of wildlife management in the National Park System is to preserve the fauna “unimpaired” (act of August 25, 1916, establishing the National Park Service). Insofar as possible, artificialities are kept at a minimum and natural forces are allowed full play. Resort to management is necessary at times, however, even in the largest and least developed of the national parks. Only a few parks or monuments are truly self-sufficient biotic units, and outside influences as well as the effects of man’s occupancy of the parks themselves sometimes require compensatory action.

Population pressures of hoofed animals in a number of the units of the National Park System continue to present problems of wildlife management of varying degrees of seriousness. The elk problem in the northern Yellowstone has existed for at least half a century. When legal hunting north of the park and live shipments from within it failed to hold this herd to the carrying capacity of the range, a considerable number of these animals had to be slaughtered, and the herd was thus reduced to a size (approximately 7,000) for which the range was reasonably adequate. Since that time, hunting in the region to which the elk migrate north of the park has been fairly successful in preventing a material increase. About 2,200 elk were removed by the 1945–46 kill, by hunters outside the park, and a reduction of 2,800 should be made in 1946–47. Some species of forage are improving, but others are making little, if any, progress. Aspen is being extirpated steadily.

Deer reductions at Zion.—Overuse of vegetation by mule deer in Zion Canyon, Zion National Park, since about 1930 had caused marked changes in the aspect of this area. The deer population, therefore, was greatly

reduced by slaughter beginning in 1943. The number of animals will be maintained at a low level for several years to come to permit full recovery of the food plants. On the east rim of Zion Canyon, where an extremely heavy deer population undoubtedly is having a bad effect on the few remaining bighorns, 112 deer were killed in 1945. Many more should be removed to better the bighorns' chance for survival.

A "surplus" of moose existed on Isle Royale, Mich., for more than a decade before inclusion of the island in the national park system. A dense beaver population also occurs on Isle Royale which, by competition for food, intensifies the plight of the moose.

A problem of many years standing in a small scenic portion of Rocky Mountain National Park appears to have been relieved during the winter of 1944-45 by the destruction of 113 deer and 301 elk. The vegetation is reported to be recovering and the remaining deer and elk are well within the carrying capacity of the range.

It is believed in some quarters that establishment of the Jackson Hole National Monument may make it difficult or impossible to control the size of the portion of the southern Yellowstone elk herd that winters on the National Elk Refuge. A portion of the monument area (Antelope Flat) has been open to hunting, and has been the scene of occasional slaughters, but under National Park Service administration would be closed to hunting. A study is being made of the migratory routes and habits of the elk in order to determine the probable effect of prohibiting hunting on Antelope Flat. The Service is cooperating with the Fish and Wildlife Service and the State authorities with the aim of simplifying, rather than making more complex, this already complicated problem.

Mount McKinley wolf reduction.—The Dall sheep population of Mount McKinley National Park has undergone marked reduction during the past decade and is now believed to number about 500 animals. Assertions that wolves are responsible for the reduction have been numerous, though studies made by Dr. Adolph Murie, of the Fish and Wildlife Service, in 1939, 1940, 1941, and again in the fall of 1945 failed to produce conclusive evidence that these assertions were correct. However, as a means of providing possible aid to the comeback of the Dall sheep, the killing of 15 wolves was authorized early in the winter. Immediate efforts to reduce the wolf population were not successful, but a part of the authorized kill was effected during the late spring and early summer of this year. The Service will take whatever steps further investigation shows to be necessary to a proper balance between wolves and sheep.

Restoration of extirpated species.—Restoration of an animal which has been exterminated from a park is desirable in order that that species may again be represented to the public, and because the primitive relationships between species should be restored. If the extirpated species is present nearby, any natural tendency to move back to the park is encouraged. Otherwise, restocking becomes necessary.

Following this principle, the bighorn was restored to Mesa Verde National Park in January 1946 after an absence of a half century, with 14 animals supplied by the Colorado Game and Fish Commission. A number of other projects of like nature should be undertaken.

As a result of a better understanding of aquatic ecology, emphasis has been given in recent years to more natural management of the park fishery. Natural spawning is being relied upon more than formerly to supply fish, though necessarily, artificial culture and restocking must continue to play a part.

Progress has been made by the Fish and Wildlife Service on studies to provide the information which is absolutely necessary for proper fishery management. The bulk of the work has been done in Yellowstone, Glacier, and Great Smoky Mountains National Parks. Research needs to be carried to completion in these parks and extended to a considerable number of other areas where fishery management problems are important and pressing.

Landing Fields in Parks Generally Unnecessary

The annual report for the fiscal year 1944 announced the Service's policy, strongly upheld by the Department, of opposing the establishment of airplane landing facilities within the parks. The policy then announced, and repeated again last year, still stands, though expressions of disagreement with it continue to be voiced by some who feel that the airplane should be accorded equal rights in the parks with the automobile.

The position of the Service is not based upon any prejudice against the airplane as a mode of transportation. It is obvious that increasing air travel to the parks is inevitable. The facts are, however, that the reasonable desires of the airplane advocates can be met quite as satisfactorily without invasion of the parks as would be possible if landing fields and servicing facilities were provided within them. Sightseeing over the parks, reasonably regulated and held to a proper altitude, may well be considered desirable at many places, but can be enjoyed as well from ports situated outside as from those which might be developed inside park boundaries.

Whatever the point at which a plane comes to earth, it then becomes necessary to utilize some other form of transportation to get the visitor and his baggage to such overnight or daytime accommodations as he may seek or to take him to the various points of interest in the park which he may wish to see. Such supplementary transportation can be supplied satisfactorily from an airport such as, for instance, that which now serves the south portion of Grand Canyon National Park or that at West Yellowstone. This is the same principle that now governs rail travel to the parks.

Visitors seek quiet.—Considering then that the lack of landing facilities in a park needs to be no handicap to either the private owner wanting to fly to it or to the commercial airline which wishes to bring visitors there by air, the disadvantages that would result from providing landing and

servicing installations in these areas fully justify the policy that has been adopted. The degree to which the low flying of take-offs and landings would prove a disturbance to park wildlife is problematical; for some rare species, such as the trumpeter swan and the sandhill crane, it would probably be serious. There is also the possibility of increased fire danger and of damage to natural features. The provision of safe facilities obviously would involve major disturbance of and extensive changes in the landscape in most of the parks. Excessive noise also would be a disturbing factor out of keeping with the atmosphere of quiet, a primary objective of most visitors to the parks. That objective would be denied if landing facilities were provided in the parks themselves.

In view of these facts, the policy to which the National Park Service is adhering seems to be abundantly justified. As a corollary of it, the Service is endeavoring to formulate and obtain approval of a regulation that would restrict flights over the parks to altitudes that would minimize disturbance and danger and assure keeping the present environment unspoiled.

Continuing study and observation, together with experience elsewhere, will throw more light on this question. Meanwhile, the Service feels that it should take a conservative position.

Increased Public Safety Sought

Considering the rugged wilderness character of many of the national parks and monuments, and the inexperience of a large proportion of visitors in such surroundings, it is to be expected that among the many million who visit them each year there will be some serious and occasional fatal accidents. No methods can be devised to prevent these entirely, but the National Park Service recognizes that the protection of visitors is a serious and sobering responsibility, and the effort to assure adequate protection is constant.

The recent tragic accident in Yosemite National Park, in which a small boy and the heroic young man who attempted to rescue him were swept to death over Vernal Falls, indicated that the protective rail at that point was inadequate to prevent children from approaching the stream above the falls; and remedial measures are being taken to prevent a recurrence of such accidents, there and at other similar places. However, the great majority of accidents result from failure to heed regulations designed for the safety of the visitor or advice that is based upon long, and often bitter, experience. All too many of them have happened to individuals who have insisted on striking out into the wilderness or undertaking hazardous climbs by themselves.

Only extraordinary good fortune brought a happy ending for the university student who wandered from his companions at the Badger Pass ski area in Yosemite National Park last winter and was lost for 11 days. In this instance, all three of the Service's repeatedly emphasized warnings

to skiers—that they should stay in groups, should stay on marked trails, and should carry matches (for both warmth and signaling should they become lost)—were disregarded.

Regulations just common sense.—It is difficult to get visitors to the parks to realize that park regulations are designed to further their safety, rather than to impose irksome restrictions on their freedom of action, though it is probable that more thought and effort need to be expended in educating visitors not only as to what the regulations are but as to the reasons that make them necessary. Probably nothing better exemplifies this difficulty than the regulations which forbid the feeding of wild animals. It hardly seems possible for anyone who can read to visit Yellowstone or Yosemite National Parks without being aware of the prohibition against feeding the bears. Yet year after year, hundreds of visitors insist on taking chances by handing these genuinely wild animals tidbits of food, and every year has its record of serious and even occasional fatal injuries to those who indulge in the practice. The Service is constantly searching for new methods of impressing upon the public the hazards of familiarity with park wildlife, as well as the injurious effects upon the wildlife itself of unsuitable diet and of dependence upon “panhandling” for food.

The Colorado River, where it runs through Grand Canyon National Park and the Boulder Dam Recreational Area, as well as its upstream reaches, has extended an invitation to the adventurous ever since Major Powell and his party made the descent in 1869. Repeatedly, however, attempts to descend the river have compelled difficult and dangerous searches of the treacherous stream. Renewed consideration is being given to recommending a regulation which would forbid any person running the rapids in Grand Canyon National Park or Boulder Dam Recreational Area, except after a showing that they are properly qualified to do so.

The National Park Service has a safety engineer whose entire time is devoted to the promotion of safety and safe practices. His concern is with the public and with the reduction of unnecessary and avoidable risks to the visitor as well as to the employees of the Service and the concessioners, and to property as well as persons. Every effort will be made to effect prompt improvement of any conditions of hazard which his studies or those of others may reveal.

Service Ill-Equipped for Information Work

The information activities of the National Park Service belong in two main categories, (1) general information, supplied through the publications issued by the Service, through newspapers, magazines, radio, and motion pictures, as well as through correspondence; and (2) interpretation, supplied usually direct to the visitor by ranger naturalists, ranger historians, museum displays, exhibits in place, and special publications. In both of these categories, the Service was compelled to function throughout the year with little more than the meager staffs of war time. Funds

for 1947 are nowhere near sufficient to afford information or interpretive services that park visitors or the public as a whole are entitled to receive.

Nature and history need interpretation.—With the cessation of hostilities and the resumption of recreational travel came an immediate demand from park visitors for the full restoration of the history and natural history interpretive programs. This demand could not be satisfactorily met during the summer months of 1946. Supplemental funds made available on January 1, 1946, enabled the Service to reemploy 19 of the 32 permanent park naturalists who had served in the armed forces or engaged in civilian war work.

So far as possible lectures and guided trips, as well as museum services, were offered during the second half of the fiscal year. Museums, many of which had been closed for the duration, were renovated and made ready for opening; the production of "Nature Notes" was resumed in some of the parks and, generally, the interpretive organizations returned to "business as usual." However, returning employees and those who remained at their posts have been handicapped by the lack of funds for the employment of seasonal ranger-naturalists. In the historical areas demands for interpretive services in many cases preceded the return of staff historians from the armed forces. By the year's end, many historians who had used their specialized training during their service with the Army or Navy, had returned to their former positions. Every effort was made to provide the utmost in service with a limited personnel.

Cooperating museum, library, and natural history associations in several parks and monuments have taken an active part in the park naturalist programs and have rendered particularly effective assistance in selling publications.

Oregon's Advisory Board on Educational Problems of Parks proposed the establishment at Crater Lake National Park of a field school of art and nature appreciation, to be a cooperative effort of the National Park Service and the extension division of the State system of higher education. The proposals submitted by officials of the University of Oregon have received consideration in conferences in the Director's Office and in Eugene, Oreg., and are still being worked upon.

Museum Division activities.—Only one permanent National Park Service exhibit was prepared and installed by Service employees during the year. This is a diorama showing the appearance of the interior of Ford's Theater on the night Abraham Lincoln was assassinated. It is exhibited in the Lincoln Museum, Ford's Theater, Washington, D. C.

Exhibit planning was continued in connection with the project construction program of physical improvements. A special study of the interpretive needs of Great Smoky Mountains National Park resulted in the completion and approval of a museum prospectus as a basis for future planning and development. Museum prospectuses were also completed for Mount Rainier, Glacier, and Zion National Parks.

Special protective and operational studies were made at the Home of Franklin D. Roosevelt previous to its opening to the public as a National Historic Site. Special museum assignments were a study of methods to be employed in an inventory of historic furnishings of the White House and completion of studies for the exhibits in the proposed William H. Jackson memorial room, Scotts Bluff National Monument.

Opportunities to inform public too limited.—During the war, the staff of the Office of Information was reduced to 10 percent of its prewar size and funds for printing of all kinds were very meager. The small staff and limited funds made possible only a bare start, before the end of the fiscal year, on the work of revising and issuing the free information literature required to meet the needs of both actual and prospective visitors, and which had been held almost completely in abeyance during the war. Publications scheduled are being limited to those required for satisfactory field operations and for meeting requests, numbering thousands daily, received by the Director's Office in Chicago, the Washington Liaison Office and the field offices of the Service.

Demands for literature grow.—Requests upon the Director's Office for printed information about the parks increased 115 percent. A much greater volume of requests go direct to the individual areas. The demands will grow as the public learns that booklets are again available. The approximately 100 percent increase in park travel indicates a similar increase in the need of free publications for distribution in the parks.

In consequence of the limited funds available, sharply reduced from the amount recommended by the Bureau of the Budget and still further reduced, in effect, by rising costs during the past few months, the production of sales publications, useful and necessary as they are, will be virtually at a standstill during the coming year.

Manuscripts go unpublished.—Manuscripts of a number of publications, which already represent a considerable investment of public funds in research and writing, must be pigeonholed for the present. This represents a loss to the public. It also is decidedly discouraging to those who have performed the laborious task of preparation. Nor does it encourage others to embark on similar undertakings when there are only slight prospects of publication. Yet these writings, which tell of the meaning of the parks, are an important phase of the Service's work.

Because of staff limitations, the Service is unable more than barely to touch certain important channels of public information, such as radio, motion pictures, illustrated lectures, and photographs. The Department's facilities for radio recording were utilized only twice during the year. A transcribed interview with the Director, to inform the public as to the condition of the parks after 4 years of war and as to the efforts of the field forces to meet the needs of visitors was put on the air by an estimated 130 stations throughout the country. In advance of the dedication of

Olympic National Park, radio coverage of the event in the Pacific Northwest was materially assisted by transcriptions of the Secretary's important dedication address, which were supplied to a number of stations in that region.

To the Service's modest library of motion picture films one picture has been added during the year. Covering Grand Teton National Park and Jackson Hole National Monument, it is composed almost wholly of footage taken by John C. Hanson of Washington, D. C., and William L. Darden of Evanston, Ill., both highly proficient photographers who gladly contributed the results of their work. The Service could readily utilize a considerable number of such films, but lacks the facilities or staff to make effective use of the few good reels it possesses or of its extensive but increasingly obsolescent collection of kodaslides.

Photographic program needed.—With the resumption of peacetime travel, the demands from magazines and newspapers for park materials, both written and photographic, have been extraordinarily heavy. The Service had hoped to be able to employ one photographer during 1947, but the funds appropriated for new positions are not sufficient to permit it. Outside demands and the requirements of the publications program justify a moderate, well-planned program for the making and distribution of photographs, so that the Service may have on hand striking current pictures, not "dated" by automobiles of ancient vintage or by evanescent feminine fashions. The subject matter of the park system deserves to be adequately pictured to the public.

Whole public should enjoy parks.—A comparatively small percentage of Americans can spend the time and funds to become well acquainted with the National Park System at first hand. A good many see few if any of the parks or monuments during a lifetime. The greater number of those who are able to visit any of them see only a small percentage of the whole. The task of the National Park Service, usually conceived to be that of providing enjoyment to those who pass through the park gates, should extend far beyond that. The motion picture, with its effective employment of color, the colored stereopticon slide, good photographs and well-illustrated publications all are capable, in a sense, of bringing the parks to the people, thereby heightening their sense of pride in what they possess and providing a high degree of enjoyment.

It is a part of the business of the National Park Service to encourage and assist the considerable number of persons who make and show good motion pictures of the parks, either as a hobby or professionally. Yet the showing of these reaches only a fraction of the potential audience. The schools, and organizations such as Parent-Teacher Associations that are closely associated with the schools, offer a mass audience which now is reached scarcely at all. Yet every school child should know about the parks—what they are and why they are—and something about how they are managed

and enjoyed. Every school should have on its walls striking pictures of the great places of America, and good books which, by picture and text, will provide knowledge and understanding of them. We believe that it should be possible to provide motion pictures of professional quality at low cost so that school groups and parents alike may derive enjoyment and satisfaction from possessions that many of them may never see in any other manner. The same is true of universities. Making this possible seems to be a legitimate field in which to expend Government funds, without neglecting any opportunity to obtain nongovernmental cooperation in its accomplishment.

Enlightened public needed.—The successful functioning of the National Park System is dependent, to an important degree, on an informed and understanding public. They are the owners of the parks. It is important to widen the circle of the adequately informed who are at the same time sufficiently concerned to take an active interest in supporting and defending sound and foresighted management of natural and historical resources. We consider it necessary and justifiable as a means of holding the successive gains in protecting and making the parks available to the people which congressional action has made possible.

The Advisory Board

The death of Dr. Thomas Barbour on January 8, 1946, was a blow to the Advisory Board on National Parks, Historic Sites, Buildings and Monuments, of which he had been a member since 1941, and to the National Park Service. His place on the board was filled by the appointment of Dr. Harold E. Anthony, dean of the Scientific Staff, American Museum of Natural History. Dr. Theodore C. Blegen, dean of the University of Minnesota Graduate School, was appointed to the vacancy caused by the death of Mr. Edmund H. Abrahams, recorded in the last annual report.

The Board's interim committee met in Washington on December 11 and 12, 1945, to consider post-war problems facing the Service. Acting through Dr. Waldo G. Leland, acting chairman of the Board, the American Council of Learned Societies sponsored a highly profitable meeting of historians at Jamestown, Williamsburg, and Yorktown on May 6 and 7, for discussion of problems relating to the utilization of historic objects and physical remains in research in American history.

Development Planning a Complicated Task

The determination and planning of desirable and essential development programs is one of the major tasks of the National Park Service. It must decide what is needed or likely to be needed, both to provide adequate service and facilities to the visitor and to facilitate administration; what sites are suitable and what kinds of structures will be appropriate and inconspicuous so that their presence will impair as little as possible the scenic, historic and scientific features which it is obligated to conserve.

The unprecedented number of visitors during the past travel season, the 5-year lag in providing additional physical improvements, and the increase of public interest in cold-weather activities which may compel the operation of several additional parks during the winter on a considerably larger scale have shown the need of reexamining existing construction plans and policies. This has been undertaken as extensively as reduced wartime staffs would permit, during the past several years.

Past studies have indicated the advisability of gradual removal of administration and concession facilities, in several of the national parks, from their present sites to new areas; of invoking again the limited-stay policies in campgrounds and concession facilities at the height of the season in such areas as Yosemite Valley; and of considering the possibility of Government construction of facilities in areas where private capital cannot be induced to provide suitable hotels, lodges, meal services and winter sports facilities. While the Service is minimizing the possible future Federal outlay for such facilities, as well as the impact of intensive use, by encouraging the provision of overnight facilities where they can be provided satisfactorily outside, some such developments must, in most cases, be located within park boundaries. The general aim is to avoid concentrations such as that which began nearly a century ago in Yosemite Valley, and to distribute the visitor load more evenly.

The immediate program.—The accumulated building demands of the nation for residential, commercial and industrial purposes are certain to make it difficult in the next few years for Government bureaus to compete in a high-priced, scarce market for skilled building workers, materials and mechanical equipment; and the obligation rests upon this and all other Federal agencies to avoid such competition as much as possible. The best course immediately open to the Service, therefore, appears to be to proceed with major repairs and rehabilitation of existing physical improvements whose usefulness can thus be extended until new facilities can be constructed; to undertake the surfacing, bridge construction and other work that will enable the public to use the roads, trails and parkway projects or parts of projects which are now only partially completed; and to install or repair the essential sewer, water, electrical and communications systems. A coordinate task is the obliteration or, where desirable use can be made of them, the repair of the roads, buildings, warning stations, pipelines and other facilities installed in various units of the park system by military or other war agencies to facilitate the conduct of the war.

The Interior Department Appropriation Act for the 1947 fiscal year makes the following provisions for developments of various kinds:

Parkways (Blue Ridge, Natchez Trace, George Washington, and Foothills), for both construction and maintenance.....	\$11, 000, 000
Roads and trails, including major and minor road and trail construction, advance plans and surveys, and approximately \$2,000,000 for maintenance.....	6, 000, 000
Physical improvements, of which \$1,000,000 is required for repair and rehabilitation of existing structures.....	1, 330, 000

Several areas still undeveloped.—Beginning with 1948 fiscal year, much larger appropriations will be needed if the signs of war use are to be obliterated, the lag in normal construction and maintenance made up, and the development of several major areas provided for. Big Bend National Park and Glacier Bay National Monument, for example, now contain practically none of the roads or other improvements which are essential to public use and enjoyment; Olympic National Park and Great Smoky Mountains National Park are in hardly better development. A number of areas are seriously in need of housing for employees, especially those who are now compelled to occupy houses almost medieval in their lack of conveniences.

Alaska areas require development.—Early development of Glacier Bay National Monument, Alaska, is of interest to the Department of Commerce, the Government of the Territory, and the Department of the Interior, because of the development during the war of a large airport at Gustavus Point, in the monument. Now operated by the Civil Aeronautics Authority, it will be the main airport for large commercial planes from the States, where passengers will transship to smaller planes for various Alaska points, or will continue on the large planes to the Orient. Facilities for the feeding and housing of, possibly, several hundred plane passengers grounded by unfavorable weather for 2 or 3 days do not exist. This factor, combined with the nearness of Juneau, the capital of Alaska, points to early and heavy visitation by both steamship and plane passengers and to the need of accommodations which would serve both groups.

At Mount McKinley National Park, the National Park Service is assisting the Alaska Railroad in developing architectural and general lay-out plans for enlargement of the hotel at McKinley Park Station, and for a lodge at Wonder Lake, situated 80 miles inside the park.

The general interest of the administration in improving the economy and encouraging settlement and development of Alaska places an obligation on the Service to make early plans for the development and administration of the five park system areas situated within the territory. Considerable progress on this task has been made during the past year.

Volume of Cooperative Work Grows

Cooperation by the National Park Service with other Federal agencies and with the States in recreational land planning studies continues to increase in volume, and is rapidly becoming a major responsibility, the extent of which is not generally realized. During 1946, for the first time, a direct appropriation was available to implement the Park, Parkway and Recreation Area Study Act of 1936. This enabled the Service to reestablish, on a modest scale, a staff of technicians whose services were provided to the States on request, to help solve State park problems.

In addition, related work performed for the Bureau of Reclamation and the Corps of Engineers was greatly enlarged. Funds allocated to the

Service by these two agencies have financed investigations of the recreational possibilities of water control projects, and assistance in planning for the protection, development and use of such resources in several major river basins and on hundreds of individual reservoir projects.

Cooperation with Federal agencies.—The National Park Service is but one of a number of Federal conservation agencies which have been called upon to appraise the potentialities, both favorable and unfavorable, of the many impoundment projects which the Bureau of Reclamation of the Department of the Interior, and the Corps of Engineers are planning or have under construction. The Service's part of this work is to determine, with respect to each of these projects, not only whether it has possibilities for recreation but also to aid in determining whether provision for it would be justified, economically and socially. It is additionally concerned with the integrity of the various units of the National Park System that may be adversely affected by such projects. In defending park areas against damage by dam-building and water-control developments, it is the duty of the National Park Service to raise the question as to whether public necessity for irrigation or flood control or generation of power outweighs the potential damage to natural scenery or to significant natural or historic or prehistoric objects or places. Allied to these considerations is concern with the scientific, historic and prehistoric values of all lands which would be affected by water-development projects and with the salvage of cultural materials from lands which are to be flooded. In several cases, such as the Missouri Basin, the Service has been asked to undertake studies on these matters well in advance of construction.

The Missouri Basin—The survey of recreational potentialities in the Missouri River Basin, related to projects of both the Bureau of Reclamation and the Corps of Engineers, begun during 1945, has been continued and enlarged during the past year. Bureau funds of \$10,000 made available for this study in 1945 were increased to \$55,000 in 1946, of which \$20,000 was put at the disposal of the Smithsonian Institution for the conduct of archeological and paleontological investigations of extraordinary importance in this particular basin.

During the past year, the field survey staff of the Service completed preliminary investigations of 11 reservoir sites for the Bureau of Reclamation and 4 for the Corps of Engineers. An expanded program for continuance of the survey has been proposed for 1947.

In other basins.—Studies similar to those in the Missouri Basin were also continued with increased impetus, in connection with other existing and proposed Bureau of Reclamation projects, by the National Park Service and Smithsonian. Following is a brief summary of these:

1. In the Colorado River Basin, preliminary recreational investigations of approximately 120 reservoir sites have been completed, and a comprehensive report has been drafted. Since the survey was started in 1941, \$93,000 has been allotted for it and for publication of the report.

2. Under cooperative agreements beginning 1941, \$19,500 has been advanced for investigations of 138 reservoir sites under consideration by region 5 of the Bureau of Reclamation on 7 river basins in Texas, Oklahoma, and parts of Kansas, Colorado, and New Mexico. An agreement for continuance of this work is being negotiated.

3. Under an agreement approved on May 27, 1946, the Service has undertaken the investigation of 16 reservoir sites in the Pacific Northwest, of which 13 are located in the Columbia Basin. To start this work, \$40,000 has been advanced and a staff is in the process of organization.

4. An investigation of four of the Bureau's Central Valley project sites in California is being conducted pursuant to a pending agreement which provides \$15,000 for the work. It is probable that the Service will be called upon to investigate numerous other projects here, both Bureau of Reclamation and Corps of Engineers.

Corps of Engineers projects.—At the request of the Chief of Engineers, made in accordance with section 4 of the Flood Control Act of 1944, the Service has continued to make preliminary investigations of water control projects under War Department jurisdiction, and to prepare recommendations for their protection and use of their recreational resources. With a fund of \$88,700 advanced by the Corps of Engineers, 68 sites were investigated during the year.

Alaska Highways Report.—The report, entitled "Recreation Resources of the Alaska Highway and Other Roads in Alaska," based upon a survey conducted during 1943-44 by the Service at the instance of the late President Roosevelt, was released by the Government Printing Office in February. Prepared with Alaska Highway funds of the War Department, the report considers the protection of scenic, scientific and historical features of lands adjacent to the highways of Alaska and provides a broad base for establishing facilities for highway travelers in the Territory.

Cooperation with the States.—The sum of \$68,000 was made available to the Service in the 1946 appropriation act for cooperation with the States in park and recreational planning. All State park agencies were advised that such cooperative assistance was again available, and 42 of them indicated their interest in obtaining it upon appropriate occasion. Forty-three requests for specific assistance have been received from 33 States, many of which have involved field consultations and investigations, covering a wide variety of problems. In addition, the Service has continued to serve as a clearing house for information on State parks and related types of areas. State Parks—1945, a pamphlet issued in June, contains tabulations of data furnished by the States on expenditures, sources of funds, attendance, personnel, and land acquisition for the fiscal year 1945.

New Area Added; Others in Prospect

On June 30, 1946, the National Park System consisted of 169 areas. One new national monument, Fort Frederica in Georgia, was established Au-

gust 30, 1945. Built in 1736 by Gen. James Edward Oglethorpe, colonizer of Georgia, the fort was an English outpost against Spain. Credit for acquisition of the lands and resultant consummation of the project is due the Fort Frederica National Monument Association.

By act of March 22, 1946, Custer Battlefield National Cemetery was made a national monument.

Funds were appropriated by the Congress late in June for acquisition of the Montezuma Well property, an area of exceptional archeological and geological interest, as an addition to Montezuma Castle National Monument, Ariz.

The eastern half of Santa Rosa Island National Monument, Fla., was eliminated from the monument and reserved for the permanent use of the War Department, by Presidential proclamation of August 13, 1945. A bill to abolish the national monument and return the remaining lands to Escambia County, for public purposes, was pending in the Congress at the end of the year and has since become law.

Wind Cave National Park was enlarged by approximately 16,000 acres under the provisions of House bill 7004, referred to elsewhere. This will provide more and better range, with an increased water supply, for the bison and antelope herds which are an interesting feature of this park.

Bill would reduce Joshua Tree Monument.—A bill to revise the boundaries of Joshua Tree National Monument, Calif., pending in the Congress at the close of the fiscal year, would also provide an appropriation of Federal funds to purchase the checkerboard of non-Federal lands within monument boundaries. The measure is designed to reduce the area by approximately a third, leaving a total of some 558,560 acres within the proposed boundaries; to consolidate and retain the lands important for their rare desert flora, scenic and geologic interest; and to delete lands in which mineral values are believed to outweigh those for which they were originally included in the monument. The lands to be excluded are not essential for national monument purposes, since they have lost their original character. Their elimination will simplify administration and will release for mining lands better suited to that use. The discriminating support of this proposed legislation by conservation organizations and individuals is gratifying in view of the pressure of some local mining interests and sportsmen to open most or all of the monument to mining and hunting regardless of the national interest.

Touro Synagogue.—Oldest structure of its type in America, Touro Synagogue in Newport, R. I., was designated a national historic site on March 5, 1946. Designed by Peter Harrison, one of the foremost architects of the colonial period and erected in 1763, it is today in essentially its original condition. The structure will remain in non-Federal ownership and will continue to be used for worship.

Pending projects progress.—The famous Adams Mansion at Quincy, Mass., home of generations of the Adams family, is destined to become the

Nation's newest national historic site. At the year's end only formalities of title acceptance remained to be cleared.

No new national park or monument projects were authorized by Congress. Little progress was made on most of the 15 previously authorized projects due to varying circumstances. Lack of funds and personnel prevented determination by the National Park Service of specific area-requirements and boundaries in those cases requiring extensive study.

Everglades project moving.—The Everglades National Park project gained new impetus with the designation by the Secretary of a minimum area which, when it has been conveyed to the Government free of all reservations, will be acceptable for park establishment. This minimum area designation in no way prejudices attainment of the larger ultimate goal envisioned by those who conceived the project, which the Congress authorized in 1934. Last year the State of Florida conveyed to the United States, subject to certain temporary reservations, all of its holdings, aggregating over 1,000,000 acres, within the minimum area. When all the private holdings within the area so designated are acquired, protection will be insured the unique biological and other features of the area now threatened with impairment or destruction. Pending park establishment, the area already acquired is administered and protected by the Fish and Wildlife Service as the Everglades National Wildlife Refuge. The enthusiasm of the new Everglades National Park Commission recently reactivated and charged by the Governor of Florida with responsibility for acquiring the lands necessary for the park augurs well for the success of the project.

Cumberland Gap project.—Substantial progress has been made by Kentucky, Tennessee, and Virginia in the acquisition of lands for the Cumberland Gap National Historical Park project. Of the 10,000 acres contemplated for this project, Tennessee has acquired virtually all of its portion; Virginia is acquiring its share as rapidly as possible. Kentucky holds title to approximately 85 percent of its quota and has appropriated \$200,000 to acquire the remainder.

The Grandfather Mountain Association, a non-Federal body established to acquire lands for this proposed addition to the Blue Ridge Parkway, continues active, but no lands for the project have yet been conveyed to the Government.

Boundaries of the lands to be included in the Harper's Ferry National Monument were approved by the Secretary, in accordance with the provisions of the Act of June 30, 1944, and the committee on Harper's Ferry National Monument is furthering the acquisition of the 1,383 acres needed for the monument.

The Effigy Mounds National Monument project, for which the State of Iowa has acquired approximately 1,000 acres, lacks only conveyance of the lands to the Federal Government to complete the project.

At the end of the year, House bill 4435, to establish the Theodore Roosevelt National Park, was pending before Congress. It was later passed and sent to President Truman, who vetoed it on the ground that the area, part of the former Roosevelt Recreational Demonstration Area, did not measure up to national park standards.

Monument and committee authorized.—Also pending at the end of the year and later passed and approved were House bill 5125 to authorize the establishment of Castle Clinton National Monument on Manhattan Island, N. Y., and House bill 2851 authorizing the creation of a committee to conduct a study and make recommendations for the establishment of “a national shrines park” centering about the Independence Hall group in the old part of the city of Philadelphia.

Boundaries and projects require study.—During the year, preliminary reports on the boundary status of the 169 areas in the National Park System were prepared in the field and submitted to the Director's Office for review and for determination of priorities for the detailed boundary studies which are to be undertaken. These reports reveal which of the areas now have satisfactory boundaries; which have definitely unsatisfactory ones; and which require further study before the question can be answered. The next step will be to determine whether and where lands are now included in the park system which should be excluded; also what lands, if any, outside of present authorized boundaries should be added. Work directed to this end has been virtually at a standstill during the war years. Material progress is confidently expected during the present year. Ultimate additions to or subtractions from any of the several groups of parks will, of course, require action by Congress.

Closely allied to this task is that of examination and appraisal of areas proposed for addition to the National Park System. Normally, 75 or more suggestions of this sort are received annually. Many proposed areas are patently unqualified and do not require field investigation. Others require careful investigation before any recommendations can be formulated. Those which possess merit, but which are not of national significance, are referred to appropriate state or local officials for consideration.

Since the investigation of proposed new areas virtually ceased throughout the war, there is now an accumulation of several hundred proposals to be studied. These are situated in all parts of the country, including Alaska and Puerto Rico. Thirteen field investigations of park and monument proposals were made during the past year. Of the approximately 50 areas proposed in that period, 17 were determined to lack proper qualifications.

The site of the first test-firing of the atomic bomb, near Alamogordo, N. M., was carefully examined and was reported on favorably with specific recommendations as to boundaries. It is expected that the area will shortly be established as the Atomic Bomb National Monument; and assurance

has been given by the Secretary of War that the airplane which dropped the bomb on Nagasaki will be made available eventually for display there. For security reasons, however, the War Department's continuing custody of the bombing area in which the site is located will defer its opening to the public for some time.

States profit from RDA transfers.—Nine more recreational demonstration areas, containing 106,504 acres, were disposed of during the year, under the authority of the act of June 6, 1942 (56 Stat. 326). The 61,539-acre Roosevelt area in North Dakota was transferred to the Fish and Wildlife Service to become the Theodore Roosevelt National Wildlife Refuge. The other eight were deeded to the States in which they are located, as follows: Alexander H. Stephens, Hard Labor Creek and Pine Mountain, Ga.; Blue Knob, Hickory Run, Laurel Hill, and Raccoon Creek, Pa.; and Swift Creek, Va. At the end of the year, legislation introduced by Representative Hoch of Pennsylvania to return the greater part of the Hopewell Village National Historic Site to recreational demonstration area status was pending. It has since been passed.

Representative Case of South Dakota introduced a bill (H. R. 7004) near the end of the year designed to dispose of the 20,404-acre Custer area in the Black Hills. This bill, passed shortly before Congress adjourned and later approved by President Truman, provided for the addition of the greater part of the area to Wind Cave National Park and for transfer of the remainder, except for a small tract to be added to the Harney National Forest, to the State for addition to Custer State Park.

President Truman has indicated that the Catoctin area in Maryland, site of the retreat used by the late President Roosevelt during the war, and frequently referred to as "Shangri La," should be transferred to the National Capital Parks. It is planned to have legislation to accomplish this introduced in the next Congress.

Six additional areas of this group, containing 36,288 acres, in California, Kentucky, Missouri, and Oregon, are available for transfer. No decision has yet been reached regarding disposition of the Camden Hills area in Maine.

Recreational Areas Need Lands and Development

The assumption of administration of the recreational lands and facilities surrounding Lake Texoma, in Oklahoma and Texas, during the past year, under a temporary cooperative agreement with the Corps of Engineers, brought to four the number of areas for which such responsibilities have been accepted for other Federal agencies. Boulder Dam Recreational Area was the first of these; near the close of 1945, the Shasta Recreational Area, and the Millerton Lake Recreational Area, both in California, were added. An agreement similar to those which apply to the Boulder Dam, Shasta

and Millerton areas is now being drafted for the Franklin D. Roosevelt Lake (Coulee Dam) area.

Effective use of all these areas is dependent on the provision of facilities for the public. A start had been made at Boulder Dam before the war. Negotiations are under way for a needed enlargement of concessioner facilities there. At Shasta and Millerton, a start has been made in determining what is needed, but no funds have been made available for more than minor developments.

Lake Texoma bristles with problems. A proposal early in the year that only two of a number of projected developments be turned over to the National Park Service, not only appeared undesirable to the Service but was strongly protested by the press, organizations and individuals in the surrounding territory, which favored following the plans for the area that had been formulated by the Service. However, though responsibility for the administration of recreation now rests with the Service, some 9,400 acres of additional land are needed. Adequate development for public use is virtually impossible so long as Federal ownership of lands bordering the lake is so seriously inadequate. Developments now under way on private lands will add greatly to the cost of ultimate acquisition.

The National Park Service did not seek this type of responsibility—the administration of recreation on lands and waters under primary jurisdiction of another agency—but it is trying to the best of its ability to carry out the mandate of Congress. No great success can be attained, however, if lands for recreational development are not acquired to meet the requirements of master plans.

Interest in parks increases in foreign countries.—Despite their countries' preoccupation with pressing postwar problems, visitors from every continent—from the Belgian Congo, Brazil, France, Great Britain, China, Denmark, Spain, Finland, the Netherlands, Sweden, Uruguay, India, Honduras—here on official missions either directly or indirectly connected with national park movements or park administration, visited and studied individual parks or the National Park System as a whole during the past 12 months.

Three French visitors made a wide swing to the parks and wildlife refuges in the West, for study of the management of such areas, with particular reference to the possible application of American practices to natural areas in the colonies. The Chinese forester who, during the past 10 years, has managed the Memorial Park of Sun Yat Sen, found his visit to a number of the parks and to Chicago and Washington offices of the Service helpful to the planning of park developments in China. The president of the Institute of National Parks in the Belgian Congo and a representative of England's Ministry of Town and Country Planning visited national park areas and found opportunity to discuss their problems with National Park Service personnel.

Requests for national park literature from many countries were numerous and were met as fully as possible.

War-use permit.—Since VJ-day most of the outstanding permits and authorizations for the use of National Park Service areas and facilities for war purposes have been terminated, and the areas are being returned as rapidly as possible to their former condition. There are still outstanding 68 permits for the use of National Capital Parks areas and 263 affecting other areas. A number of these are now in the process of termination; the War and Navy Departments are continuing to use certain areas on a temporary basis. One parcel of $3\frac{1}{2}$ acres of land was transferred permanently from National Capital Parks to the War Department; seven parcels from other areas in the National Park System, containing a total of 9,600 acres, were transferred to the War and Navy Departments.

During the entire war period, 107 war-use permits were issued for occupancy of National Capital Parks lands, 2,204 for various uses of other National Park System areas. Of the latter group, 6 involved temporary transfer of jurisdiction; 80 were for utilization of minerals, timber, forage or water; 244 for occupancy and use of lands and facilities; 16 for exclusive use of concessioner facilities; 1058 for field exercises; 52 for rights-of-way; 32 for loan or transfer of material or equipment; 655 for hauling over parkways or park roads; and 61 for miscellaneous purposes. No major damage was caused to the National Park System by these war uses.

Dedications Mark Service's Thirtieth Anniversary

Nineteen forty-six brings the National Park Service to the thirtieth year of its existence, the act which established it having been signed by President Woodrow Wilson on August 25, 1916. Shortly thereafter, Stephen T. Mather was appointed its first director, and the fledgling Bureau took over administration of the 14 national parks and 21 national monuments that were then administered by the Department of the Interior.

The thirtieth anniversary of the Service has been variously noted in the press and over the radio. In a number of parks special exhibits have reviewed the history of the Bureau and the development of the National Park System. It has been especially marked by the dedications, already observed or to be observed, of four areas. Three of these, all national parks, have been members of the system for more than 5 years, while the fourth, the Home of Franklin D. Roosevelt National Historic Site, came into Federal possession during the past year.

An act of Congress approved in 1939 (53 Stat. 1062) authorized the head of any executive department to accept any part of the Hyde Park estate of President Roosevelt "for use in connection with any designated function of the Government administered in such department." It was pursuant to the terms of this act that the late President's home and 33 acres of land surrounding it became Federal property in November 21, 1945, and assumed full status as a national historic site. Left subject to lifetime rights

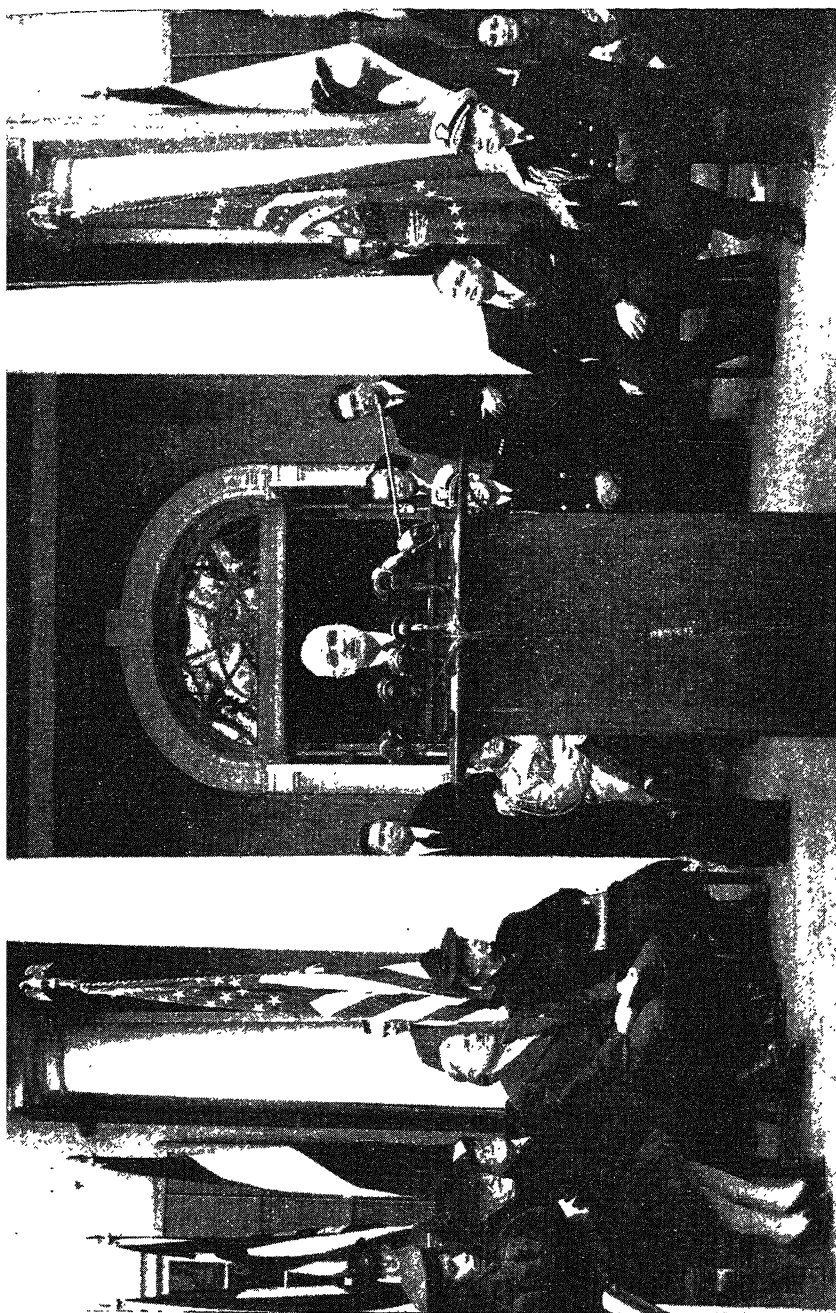


FIGURE 7.—President Truman delivered the dedication address from the front porch at the Home of Franklin D. Roosevelt National Historic Site on April 12, first anniversary of the late President's death.

of use and occupancy by the members of the immediate family, these rights had been surrendered by Mrs. Roosevelt and all the children in order that provision might be made for immediate public use.

The dedication, on April 12, exactly a year after the President's death, was held from the front porch of the interesting, beautifully situated home in which the former Chief Executive had been born and where he had lived most of the happiest years of his life. Some 10,000 persons were present. President Truman delivered a tribute to his predecessor; Mrs. Franklin D. Roosevelt made a brief address of presentation, and Secretary J. A. Krug formally accepted the estate in behalf of the United States. Miss Marian Anderson sang *The Star Spangled Banner*. Director Newton B. Drury of the National Park Service presided. In the audience were high-ranking representatives of the three major branches of the Federal Government as well as of State and local governments, and many of the diplomatic representatives of the United Nations. The radio coverage given the ceremony was one of the most extensive in history.

On the occasion of his first trip to the West after assuming his present office, Secretary Krug also participated in the dedication of Olympic National Park, the 848,000-acre mountain and forest wilderness of northwestern Washington. The ceremony was held on the grounds of Rosemary Inn, on the shores of mountain-surrounded Lake Crescent. On the program were Gov. Mon C. Wallgren, who as a member of the United States Senate had sponsored the legislation to establish the park; Senator Hugh B. Mitchell; and Representative Henry M. Jackson, in whose district most of the park is situated. The gist of Secretary Krug's important statement of policy regarding the preservation of the virgin timber of the park is given elsewhere in this report.

Scheduled for dedication ceremonies are Isle Royale National Park, Mich., on August 27, and Mammoth Cave National Park, Ky., on September 18.

Service Is Seriously Short of Personnel

To accomplish the tasks which the people and the Congress expect of the National Park Service and which are its responsibility under the law, and also to maintain needed protection and services under present conditions, there is a pressing need for additional personnel. The need of larger staffs in the field, to serve the tide of visitors now flowing in, is desperate. As indicated elsewhere, this need is made more critical by the 40-hour work week and overtime requirements. Almost impossible burdens will be imposed upon a loyal staff until further increases in appropriations make it possible to establish an adequate number of additional positions. Few areas are now sufficiently staffed to permit shifting hours of duty to the extent necessary for the conduct of operations 7 days a week; yet 7 days service must be given at most areas a large part of the year. A few of the smaller historical areas close 1 day a week—which gives the personnel

some relief, but which also works a hardship on the visitor from afar who does not know in advance of such closing.

The personnel shortage is acute also in the Director's office in Chicago, the liaison office maintained in Washington, and the four regional offices. It perhaps hits hardest administrative and professional heads who now endeavor to carry on with little or no assistance, but whose efforts, for that reason, do little more than "plug holes in the dike." These responsible employees should have time to think and to work on fundamental problems. It is unsound, economically and professionally, to expect them to carry on without adequate staffs, to devote much of their time to clerical and minor professional tasks, and still to be ridden by the consciousness of work that needs doing but that must remain undone.

No more critical problem confronts the Service during the coming year than that of providing relief to conscientious and overworked personnel. Allied to this need is the necessity of reallocating the technical and administrative positions to bring them in line with those of similar responsibility in other Federal agencies. Until this is done, the Service cannot compete with other agencies in filing vacancies scaled one or two grades lower than comparable positions elsewhere.

The loyalty and high caliber of the Service staff is attested by the fact that few of its professional and administrative officials have been lured elsewhere by the prospect of higher salaries. It is not too much to say that money could not buy the devotion to duty that they have shown during the war years and during the months since the end of the war.

TABLE 1.—*National Park System, travel and area data, June 30, 1946*

[Travel figures for the fiscal year, July 1, 1940-June 30, 1941, the last full fiscal year before the war, are not available for comparison with those of the 1946 fiscal year. Figures for the travel year of 1941, therefore, have been included.]

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945-June 30, 1946	Approximate visitors, travel year Oct. 1, 1940-Sept. 30, 1941
NATIONAL PARKS				
Acadia.....	Maine.....	28,382.21	31,424	423,088
Big Bend.....	Texas.....	691,338.95	6,379	(1)
Bryce Canyon.....	Utah.....	36,010.38	73,780	124,098
Carlsbad Caverns.....	New Mexico.....	45,526.59	295,244	284,024
Crater Lake.....	Oregon.....	160,290.33	97,710	273,564
Glacier.....	Montana.....	997,486.80	96,878	179,082
Grand Canyon.....	Arizona.....	645,135.91	333,969	431,816
Grand Teton.....	Wyoming.....	94,892.92	56,604	125,129
Great Smoky Mountains.....	Tennessee, North Carolina.....	460,882.46	945,468	1,247,019
Hawaii.....	Territory of Hawaii.....	173,404.60	418,801	324,728
Hot Springs.....	Arkansas.....	1,019.13	293,461	203,093
Isle Royale.....	Michigan.....	133,838.51	6,122	7,257
Kings Canyon.....	California.....	452,904.82	135,183	172,271
Lassen Volcanic.....	do.....	103,269.28	53,752	108,663
Mammoth Cave.....	Kentucky.....	50,547.51	104,237	158,772
Mesa Verde.....	Colorado.....	51,017.87	21,713	42,079
Mount McKinley.....	Alaska.....	1,939,199.04	133	1,700
Mount Rainier.....	Washington.....	241,524.77	398,458	446,636
Olympic.....	do.....	848,212.30	116,624	92,968
Platt.....	Oklahoma.....	911.97	438,450	316,169
Rocky Mountain.....	Colorado.....	252,625.87	476,098	685,393
Sequoia.....	California.....	385,100.13	227,211	300,012
Shenandoah.....	Virginia.....	193,472.98	690,413	1,054,479

See footnotes at end of table.

TABLE 1.—National Park System, travel and area data, June 30, 1946—Continued

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1940–Sept. 30, 1941
NATIONAL PARKS—continued				
Wind Cave.....	South Dakota.....	11, 718. 17	30, 589	21, 080
Yellowstone.....	Idaho, Montana, Wyoming.....	2, 213, 206. 55	348, 880	581, 761
Yosemite.....	California.....	756, 294. 65	482, 913	594, 062
Zion.....	Utah.....	94, 241. 06	137, 987	190, 016
Total.....		11, 062, 455. 76	6, 318, 481	8, 388, 909
NATIONAL HISTORICAL PARKS				
Abraham Lincoln.....	Kentucky.....	110. 50	37, 666	115, 726
Chalmette.....	Louisiana.....	33. 25	51, 588	25, 408
Colonial.....	Virginia.....	7, 057. 16	378, 158	2 643, 037
Morristown.....	New Jersey.....	958. 37	257, 904	221, 779
Total.....		8, 159. 28	725, 316	1, 005, 950
NATIONAL MONUMENTS				
Ackia Battleground.....	Mississippi.....	49. 15	(3)	(3)
Andrew Johnson.....	Tennessee.....	17. 08	20, 500	(1)
Appomattox Court House.....	Virginia.....	968. 25	12, 800	2 50, 000
Arches.....	Utah.....	33, 769. 94	1, 371	3, 786
Aztec Ruins.....	New Mexico.....	25. 88	7, 154	12, 631
Badlands.....	South Dakota.....	122, 812. 46	75, 235	251, 498
Bandelier.....	New Mexico.....	27, 048. 89	16, 538	11, 727
Big Hole Battlefield.....	Montana.....	200. 00	1, 770	(1)
Black Canyon of the Gunnison.....	Colorado.....	13, 176. 02	7, 599	18, 444
Cabrillo.....	California.....	. 50	(3)	(3)
Canyon de Chelly.....	Arizona.....	83, 840. 00	1, 299	1, 916
Capitol Reef.....	Utah.....	33, 068. 74	(3)	(3)
Capulin Mountain.....	New Mexico.....	680. 42	16, 750	35, 550
Casa Grande.....	Arizona.....	472. 50	24, 582	18, 084
Castillo de San Marcos.....	Florida.....	18. 51	260, 192	297, 620
Castle Pinckney.....	South Carolina.....	3. 50	(3)	(3)
Cedar Breaks.....	Utah.....	6, 052. 20	18, 514	16, 516
Chaco Canyon.....	New Mexico.....	18, 039. 39	1, 466	1, 724
Channel Islands.....	California.....	1, 119. 98	(3)	(3)
Chiricahua.....	Arizona.....	10, 529. 80	8, 646	12, 069
Colorado.....	Colorado.....	18, 120. 55	25, 652	31, 333
Craters of the Moon.....	Idaho.....	47, 210. 67	10, 639	21, 796
Custer Battlefield.....	Montana.....	765. 34	33, 569	65, 132
Death Valley.....	California.....	1, 850, 565. 20	72, 499	96, 529
Devil Postpile.....	do.....	798. 46	(3)	(3)
Devils Tower.....	Wyoming.....	1, 193. 91	16, 197	32, 951
Dinosaur.....	Colorado, Utah.....	190, 798. 49	5, 355	9, 133
El Morro.....	New Mexico.....	240. 00	1, 217	1, 300
Father Millet Cross.....	New York.....	. 01	(3)	(3)
Fort Frederica.....	Georgia.....	74. 53	4, 900	(1)
Fort Jefferson.....	Florida.....	86. 82	5, 588	918
Fort Laramie.....	Wyoming.....	214. 41	7, 606	6, 747
Fort Matanzas.....	Florida.....	18. 34	9, 156	17, 055
Fort McHenry.....	Maryland.....	47. 64	439, 357	660, 403
Fort Pulaski.....	Georgia.....	5, 427. 39	(1)	55, 536
Fossil Cycad.....	South Dakota.....	320. 00	(3)	(3)
George Washington Birthplace.....	Virginia.....	393. 68	23, 413	52, 429
Gila Cliff Dwellings.....	New Mexico.....	160. 00	(3)	330
Glacier Bay.....	Alaska.....	2, 297, 456. 27	(3)	(3)
Grand Canyon.....	Arizona.....	196, 051. 00	46	(2) 324
Gran Quivira.....	New Mexico.....	450. 94	1, 131	2, 974
Great Sand Dunes.....	Colorado.....	36, 609. 19	6, 121	11, 171
Holy Cross.....	do.....	1, 392. 00	(3)	(1)
Homestead.....	Nebraska.....	162. 73	189	(1)
Hovenweep.....	Utah, Colorado.....	299. 34	132	299
Jackson Hole.....	Wyoming.....	173, 064. 62	(3)	(3)
Jewel Cave.....	South Dakota.....	1, 274. 56	1, 748	4, 901
Joshua Tree.....	California.....	655, 961. 33	35, 040	(1)
Katmai.....	Alaska.....	2, 697, 590. 00	(3)	(3)
Lava Beds.....	California.....	45, 867. 56	23, 325	34, 659
Lehman Caves.....	Nevada.....	640. 00	2, 402	(1)
Meriwether Lewis.....	Tennessee.....	300. 00	7, 552	21, 281
Montezuma Castle.....	Arizona.....	521. 41	11, 077	9, 435
Mound City Group.....	Ohio.....	57. 00	(3)	(3)
Muir Woods.....	California.....	424. 56	222, 471	133, 517
Natural Bridges.....	Utah.....	2, 649. 70	413	618
Navajo.....	Arizona.....	360. 00	351	566
Ocmulgee.....	Georgia.....	683. 48	32, 196	63, 330
Old Kasaan.....	Alaska.....	38. 00	(3)	(3)

See footnotes at end of table.

TABLE 1.—National Park System, travel and area data, June 30, 1946—Continued

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1946–Sept. 30, 1941
NATIONAL MONUMENTS—CON.				
Oregon Caves.....	Oregon.....	480.00	29,626	57,704
Organ Pipe Cactus.....	Arizona.....	328,161.73	75,484	9,780
Perry's Victory.....	Ohio.....	14.25	35,740	41,956
Petrified Forest.....	Arizona.....	85,303.63	199,390	240,967
Pinnacles.....	California.....	12,817.77	14,097	28,036
Pipe Spring.....	Arizona.....	40.00	1,046	1,914
Pipestone.....	Minnesota.....	115.60	3,889	2,785
Rainbow Bridge.....	Utah.....	160.00	(³)	367
Saguaro.....	Arizona.....	53,669.24	15,585	15,167
Santa Rosa Island.....	Florida.....	4,800.00	416,459	405,968
Scotts Bluff.....	Nebraska.....	2,196.44	43,842	80,206
Shoshone Cavern.....	Wyoming.....	212.37	(³)	(³)
Sitka.....	Alaska.....	57.00	3,987	9,151
Statute of Liberty.....	New York.....	10.38	529,140	446,364
Sunset Crater.....	Arizona.....	3,040.00	6,773	12,944
Timpanogos Cave.....	Utah.....	250.00	40,128	10,864
Tonto.....	Arizona.....	1,120.00	11,367	9,423
Tumacacori.....	do.....	10.00	17,014	8,912
Tuzigoot.....	do.....	42.67	8,708	9,350
Verendrye.....	North Dakota.....	253.04	(³)	(³)
Walnut Canyon.....	Arizona.....	1,641.62	15,804	12,623
Wheeler.....	Colorado.....	300.00	(³)	(³)
White Sands.....	New Mexico.....	140,247.04	72,345	79,069
Whitman.....	Washington.....	45.84	(³)	(³)
Wupatki.....	Arizona.....	34,693.03	2,349	4,153
Yucca House.....	Colorado.....	9.60	47	72
Zion.....	Utah.....	33,920.75	(³)	(³)
Total.....		9,283,794.34	3,016,528	3,749,452
NATIONAL MILITARY PARKS				
Chickamauga and Chattanooga.....	Georgia, Tennessee.....	8,146.33	206,050	371,616
Fort Donelson.....	Tennessee.....	102.54	18,885	41,908
Fredericksburg and Spotsylvania.....	Virginia.....	2,420.15	66,271	156,038
Gettysburg.....	Pennsylvania.....	2,463.46	397,259	654,411
Guilford Court House.....	North Carolina.....	148.83	30,098	53,203
Kings Mountain.....	South Carolina.....	4,012.00	26,601	24,442
Moore's Creek.....	North Carolina.....	30.00	4,343	4,458
Petersburg.....	Virginia.....	1,324.62	147,413	263,169
Shiloh.....	Tennessee.....	3,717.59	157,894	233,439
Stones River.....	do.....	323.86	28,143	6,542
Vicksburg.....	Mississippi.....	1,323.56	14,654	212,154
Total.....		24,012.94	1,097,611	2,021,380
NATIONAL HISTORIC SITES				
Atlanta Campaign Markers.....	Georgia.....	20.96	(³)	(³)
Federal Hall Memorial.....	New York.....	.49	68,175	(³)
Fort Raleigh.....	North Carolina.....	16.45	24,882	76,016
Home of Franklin D. Roosevelt.....	New York.....	33.23	113,772	(¹)
Hopewell Village.....	Pennsylvania.....	6,197.00	63,946	85,562
Jefferson National Expansion Memorial.....	Missouri.....	82.58	33,940	(³)
Manassas Battlefield Park.....	Virginia.....	1,604.57	7,104	7,735
Old Philadelphia Custom House.....	Pennsylvania.....	.79	27,238	(³)
Salem Maritime.....	Massachusetts.....	8.61	6,714	7,172
Vanderbilt Mansion.....	New York.....	211.65	26,426	17,669
Total.....		8,176.33	372,197	194,154
NATIONAL BATTLEFIELD SITES				
Antietam.....	Maryland.....	183.32	26,056	32,165
Brice Cross Roads.....	Mississippi.....	1.00	(³)	(¹)
Cowpens.....	South Carolina.....	1.00	407	(³)
Fort Neessity.....	Pennsylvania.....	2.00	57,968	81,803
Kennesaw Mountain.....	Georgia.....	60.00	25,139	14,450
Tupelo.....	Mississippi.....	1.00	(³)	(¹)
White Plains.....	New York.....		(³)	(³)
Total.....		248.32	109,570	138,618
NATIONAL BATTLEFIELD PARKS				
Richmond.....	Virginia.....	684.44	17,035	(¹)

See footnotes at end of table.

TABLE 1.—National Park System, travel and area data, June 30, 1946—Continued

Areas (classification)	State	Federal land acres	Approximate visitors, fiscal year July 1, 1945–June 30, 1946	Approximate visitors, travel year Oct. 1, 1940–Sept. 30, 1941
NATIONAL MEMORIALS				
House Where Lincoln Died.....	District of Columbia.....	.05	66,226	32,883
Kill Devil Hill.....	North Carolina.....	314.40	20,461	84,194
Lee Mansion.....	Virginia.....	.50	304,433	358,791
Lincoln Memorial.....	District of Columbia.....	.61	681,932	1,796,752
Lincoln Museum.....	do.....	.18	106,335	52,541
Mount Rushmore.....	South Dakota.....	1,686.40	147,520	(¹)
New Echota Marker.....	Georgia.....	.92	(³)	(¹)
Thomas Jefferson.....	District of Columbia.....	1.20	661,508	(¹)
Washington Monument.....	do.....	.37	751,382	939,458
Total.....	.....	2,004.63	2,739,797	3,670,619
NATIONAL CEMETERIES				
Antietam ⁵	Maryland.....	11.36	(³)	.....
Battleground.....	District of Columbia.....	1.03	2,700	(¹)
Fort Donelson ⁵	Tennessee.....	15.34	(³)	.....
Fredericksburg ⁵	Virginia.....	12.00	(³)	.....
Gettysburg ⁵	Pennsylvania.....	15.55	(³)	.....
Poplar Grove ⁵	Virginia.....	8.72	(³)	.....
Shiloh ⁵	Tennessee.....	10.25	(³)	.....
Stones River ⁵	do.....	20.09	(³)	.....
Vicksburg ⁵	Mississippi.....	119.76	(³)	.....
Yorktown ⁵	Virginia.....	2.91	(³)	.....
Total.....	.....	217.01	2,700	5,000
NATIONAL CAPITAL PARKS				
The Park System of the District of Columbia.....	District of Columbia, Maryland, and Virginia.....	27,790.36	(³)	(³)
PARKWAYS				
Blue Ridge.....	North Carolina, Virginia.....	38,911.50	683,959	965,507
George Washington Memorial.....	Virginia.....	2,458.68	(³)	(³)
Natchez Trace.....	Tennessee, Alabama, Mississippi.....	13,648.87	(³)	(³)
Total.....	.....	55,019.05	683,959	965,507
Total—National Park System.	.....	20,472,562.46	15,083,194	20,139,589
NATIONAL RECREATIONAL AREAS				
Boulder Dam.....	Arizona-Nevada.....	1,680,133.33	992,397	838,246
Lake Texoma.....	Texas-Oklahoma.....	.....	(³)	(³)
Shasta Dam.....	California.....	.....	(³)	(³)
Millerton.....	do.....	.....	(³)	(³)
Total.....	.....	.....	992,397	838,246
PROJECTS ⁶				
Saratoga National Historical Park.....	New York.....	1,864.60	19,243	(¹)
Kennesaw Mountain National Battlefield Park.....	Georgia.....	3,034.21	(⁵)	(⁵)
Cape Hatteras National Seashore R.A.....	North Carolina.....	74.00	(³)	(³)
Olympic Public Works project.....	Washington.....	43,359.36	(³)	(³)
Total.....	.....	48,332.17	19,243	72,591
Grand total.....	.....	22,201,027.96	16,094,834	21,050,426

¹ Not established in 1941.² Estimated.³ Travel figures not available or maintained.⁴ Closed to visitors.⁵ Included in travel figures for adjacent battlefield site, military park, or historical park.⁶ Includes only those in which lands are under National Park Service administration.

Office of Indian Affairs

WILLIAM A. BROPHY, *Commissioner*



THE fiscal year which ended June 30, 1946, was a period of change and movement for the American Indians as it was for the world at large. Not long after the fiscal year began, World War II ended. The 25,000 Indian men and women who had served in the armed forces and the 40,000 others who had engaged in war work had made a record which stood comparison with that of any other group.

The termination of the war, however, brought new problems to the Indians. Old problems were accentuated.

These became also the concern of the Office of Indian Affairs which protects the interests of more than 400,000 Indians, Eskimos and Aleuts, and strives to help them become self-governing and economically independent. This Office has responsibility under the direction of the Congress and the Department of the Interior for carrying out the provisions of the many treaties, agreements and laws which govern the relations of these citizens with the Federal Government.

Cessation of hostilities marked the beginning of a profound change in their fortunes. Wages from war work vanished. Dependency allotments sent home by servicemen and women began to dwindle as the armed forces diminished. A downward trend in family incomes set in.

Those incomes never had been adequate. Although in the war year of 1944 the individual income total was approximately $2\frac{1}{2}$ times that of 1938, one-third of the Indian families resident on the reservations still had incomes of less than \$500 in 1944 and nearly two-thirds received less than \$1,000.

Balanced against this situation were new factors born directly or indirectly of war and wartime conditions. Many thousands of Indians who had never been far from a reservation had attained widened viewpoints in the military camps and in the factories of this country, and in the far reaches of the earth. New opportunities opened to some. The imperative need of adequate education was brought home to many. Standards of living had risen for thousands. Veterans had acquired benefits under the Servicemen's Act of 1944, as amended, and other legislation.

Indian Service Reorganization

In order better to solve the problems, old and new, and to render more efficient service to the Indians, a reorganization of the field installations throughout continental United States was prepared during this fiscal year for immediate operation with the beginning of the next fiscal year.

The reorganization, designed to increase administrative effectiveness, sets up five districts geographically, each including Indian Service installations within a group of States. Headquarters are at Minneapolis, Minn., Billings, Mont., Portland, Oreg., Phoenix, Ariz., and Oklahoma City, Okla.

More than 40 "at large" offices or stations were eliminated, their activities being taken over by the district offices to concentrate the technical services they performed. It was planned also to delegate to district directors and agency superintendents authority to act on many matters hitherto handled by the central office. This decentralization of authority from the central office and the concentration of technical services in the district offices was expected to cause on-the-ground teamwork which would result in greater promptness in meeting local and regional needs and in greater uniformity, since these needs are often not essentially local but are identical or similar over large, contiguous areas.

Delegation of Authority

A bill (H. R. 4386) designed to facilitate and simplify the administration of laws governing Indian affairs, was before the Congress during this fiscal year. It would authorize the Secretary of the Interior to delegate from time to time and to the extent and under such regulations as he deems proper, his powers and duties under those laws to the Commissioner of Indian Affairs, insofar as the powers and duties relate to action in individual cases arising under general regulations promulgated by the Secretary. It also authorizes the Commissioner to delegate various powers and duties to personnel in the field.¹

Appropriations Consolidated

A very definite improvement of budgetary procedures was achieved during the year through the consolidation of appropriations from 116 titles to 29. This amounted to a complete revision of budget structure and has made for such efficiency that any interested person, looking at the 29 permanent titles, can tell how much the administrative expense is, and how much each one of the major activities such as education, health, forestry, etc., cost in 1 year. Previously there had been so many separate appropriations that the actual cost of administering the activities of the Indian Service could be ascertained only by a great deal of analysis.

¹ The President signed the bill Aug. 8, 1946. It had been passed by the Congress during the fiscal year, but reconsideration of the vote was ordered by the Senate, which passed it July 29, 1946, with amendment. The House concurred July 30.

Postwar Changes

It is expected that the reorganization and the addition of new powers to field officials will be of considerable aid in their efforts to help Indians, Eskimos, and Aleuts faced by postwar difficulties. The new factors which accompanied the war and its termination were having their effects. There were plentiful evidences of that during the fiscal year, but it was still too early to determine whether there were any general war-induced trends which would persist in the future.

A question which presented itself was whether there would be any general drift away from the Indian homelands. None was discernible in preliminary reports from the reservations and Indian communities. Those reports did indicate that a large majority of veterans and war workers had returned.

There was the further question as to how many would remain and how many would take advantage of opportunities seen outside the reservations. Early in 1946, many of the reservations reported the belief that the great majority, and in some instances all, would remain. Military service in some cases seemed to have drawn veterans closer to their homes, as was reported at the Navajo Reservation in Arizona, New Mexico, and Utah, even though educational and economic opportunities there are poor. This trend is little different from that of the non-Indian population. The people were returning to their homes.

In various places, it was believed that some Indians would do as they had done in the past, take temporary employment outside when it was offered, but return to their own lands when employment ceased.

On the other hand, from the Shawnee Agency in Oklahoma came word that the war seemed to have made Indians there dissatisfied with opportunities for making a living on the reservation so long as they could get outside employment, but this was recognized to be merely an acceleration of a process which had begun prior to the war. A similar condition was reported at the Potawatomi Agency in Kansas where it was felt that participation in the war and in war work had speeded tremendously the processes of Indian assimilation into the social, economic, and political life of the United States.

Another report stated that some Indians had not returned to the reservation when their war jobs ended but had applied for relief money in the communities where they were.

It became clear that Indians of the postwar world were attacking their problems of readjustment according to no fixed pattern. Their approaches to the task were as varied as those of other citizens. For they earn their livelihoods according to the conditions which obtain in their environments. They are farmers, stockmen, fishermen, lumbermen, or workers in other occupations in accordance with the nature of the country in which they live. These and many other occupations are followed by Indians. Some never have lived on a reservation, but have earned their livings in city or

town, on farm or ranchland far from reservations, and some even in foreign countries, and have little or no contact with the Indian Service.

Pueblo Food Offer

Concern of the native peoples with postwar difficulties has not been confined to their own. Last spring nine Indian Pueblos in New Mexico, having heard from their warrior sons that people were starving in Europe and Asia, acted with characteristic generosity. They sent the following communication to Fiorello H. LaGuardia, director general of the United Nations Relief and Rehabilitation Administration:

This is the Governors of the Indian Pueblos in New Mexico that is writing you this letter. This is what we say. Our peoples been hearing lots about the peoples and childrens in Europe and China that are starving. So we been talking over with our Councils and we talk it together. So we write you this letter.

Us Pueblo Indian peoples been living in this country long time. Our peoples they are good farmers but even if they good farmers they not raising much even in good years when lots of rain. Our peoples pray and dance for rain and live right but even in good years we raise only enough to feed ourselves. Our old custom tell us to save every year part of what we raise for like an emergency or crop failure next year. This not much but all we have.

Looks like those peoples and childrens over there got emergency. Lots of our Pueblo boys that went to war for this country, now they back here. They tell us all they see. Our peoples proud of their sons and so glad they back home again to forget the war and live the right way for peace.

Pretty hard for peoples and childrens to forget the war and live the right way for peace with empty bellies. So we say we haven't got much saved for our emergency but they got emergency over there so maybe we can help some. We got little corn and little wheat for that to be use. Our Superintendent tell us you are the man that is sending corn and wheat to them peoples and childrens over there so we write you this letter so take part of our corn and wheat for them peoples. That is what we say.

Eskimo Generosity

And when the school children in the little Eskimo village at Noorvik in Alaska were told by their teacher that people were starving overseas, they informed their parents. An auction sale of second-hand articles was held. A Treasury check for \$40, the entire proceeds, was sent to UNRRA.

This was the donation of a village of 234 people who have their own food shortage every year. If the caribou fail to migrate near their village, or if the spring is late and the seal do not come in at their regular time the people are apt to go hungry.

Aid to Veterans

Even before peace was an accomplished fact, the Office of Indian Affairs recognized that the welfare of the returned veteran was essential to future Indian economic and governmental independence. Preparations were made to give assistance. Reservation superintendents laid their plans.

They went into action when victory was won. In some instances, letters were sent to men and women in the armed forces as to their future plans and as to their desire for assistance.

Veterans had acquired new rights to education, vocational and academic, to financial aid if unemployed, and to Federal help in obtaining commercial loans to acquire homes or engage in business ventures. It was realized early that special action should be taken to encourage qualified Indian veterans to take advantage of the guaranty loan provisions of the G. I. Bill of Rights before seeking loans from tribal funds or the Federal revolving credit funds.

Consequently in November 1945 reservation superintendents and other Indian Service personnel were acquainted not only with the Indian veterans' basic rights, which are identical under the law with those of other veterans, but also with special provisions established by the Office of Indian Affairs to aid them in getting loans from commercial sources. While Indians may not mortgage or assign trust lands, it was provided that Indian agency superintendents may authorize the use of income from such lands as security for loans partially guaranteed by the Veterans' Administration. Another provision was that veterans, who have obtained loans on livestock, may authorize lenders to enter immediately upon the trust land upon default and to operate thereon the repossessed livestock for not more than 90 days, and the privilege holds good for stock operated on tribal lands, if the tribe gives consent. Other liberal provisions were made.

In localities where Indian veterans have found difficulty in obtaining funds from commercial lenders, efforts are made by Indian Service personnel to get for them the same kind of treatment that is accorded to other veterans. The use of tribal funds or of revolving credit funds, which are very limited, is encouraged only if a commercial loan cannot be obtained.

Tribal Help to Veterans

Tribes which are conducting lending operations have passed resolutions extending preference to veterans, and in other ways returning veterans have been given special consideration by the governing bodies of the tribes of which they are members. Sioux Indians of the Cheyenne River Reservation in South Dakota were so proud of their 376 young men and women in the armed forces that they voted a \$25 bonus to each honorably discharged veteran, at a total expenditure of about \$9,400.

Veterans in many instances have taken an active part in tribal affairs. One of the 16 tribal delegations which visited this Office during the fiscal year was composed entirely of veterans. Five others had one war veteran member each.

Personnel in all branches and components of the Indian Service has given assistance to the veterans. Establishment of veterans in income-producing enterprises through extension of credit and through formulation of adapt-

able farm plans has been a regular part of the program. Upon entering the armed forces many Indians did not liquidate their assets but left their livestock and farms in the hands of relatives, who carried on. Operations generally continued satisfactorily, and the returning veterans have found themselves able to readjust more readily.

On-the-Farm Training

Special attention has been given to on-the-farm training in cooperation with the Veterans' Administration and the Indian schools or, where possible, with the public schools. Under this program veterans who own or lease farms receive classroom instruction, and supervision and on-the-farm instruction by agricultural experts. They receive also the customary subsistence allowances under the Servicemen's Readjustment Act of 1944, as amended.

One of the most significant is the program at the Cherokee Central School on the Cherokee Reservation in North Carolina. Here approximately 70 veterans are farming under that plan. Supervisors in agriculture and livestock work help the veteran to plan his operations and supervise his work on the farm, as well as give him instruction at weekly sessions at the school. At this agency, 69 farm plans have been made for veterans during the fiscal year. Training in soil and moisture conservation is an important element.

Education for Veterans

Vocational training is another part of the educational program being conducted in cooperation with the Veterans' Administration. An example is the work at the Cherokee Central School where approximately 30 men engaged in this kind of training. It includes courses in carpentry, painting, plumbing, electrical work, automobile mechanics, and arts and crafts.

Indian Service schools enrolled a considerable number of returned veterans during the fiscal year. Haskell Institute at Lawrence, Kans., received 85 and Chilocco Indian Agricultural School at Chilocco, Okla., enrolled 43. Other veterans entered Sequoyah Training School at Tahlequah, Okla., Flandreau School at Flandreau, S. Dak., Albuquerque School at Albuquerque, N. Mex., Sherman Institute at Riverside, Calif., and Chemawa School at Chemawa, Ore. There was a consistent demand among veterans for high school studies and specialized vocational training.

On-the-job training has claimed the interest of many Indian veterans. It is carried on through cooperation with the Veterans' Administration. An outstanding example is a course at Menominee Indian Mills in Wisconsin, where members of the tribe operate a logging and lumbering business. More than 50 veterans undertook training in many of the technical phases of the lumber industry to fit themselves to do expert work, especially

in the Menominee forest, which is managed in accordance with conservation principles and provides employment for 500 men.

Training of World War II veterans within the Indian Service has been arranged in accordance with an agreement between the Department of the Interior and the Veterans' Administration. In general, it will be restricted to present and prospective employees of the Indian Service, especially Indians. If an Indian Service unit, however, is especially equipped to carry on training in some field desired by veterans living on the reservation and if equivalent training is not available elsewhere, others than present or prospective employees will get the training.

Indian veterans have manifested a considerable interest in the various veterans' organizations. A number of all-Indian posts have been formed, and other veterans have joined posts the members of which are both Indian and non-Indian.

Indian Schools

The education of children in Indian schools still felt the effect of war-time conditions during the school year of 1945-46, corresponding to the fiscal year of 1946. There was, however, a small increase in the average daily attendance over that of the previous year. Daily attendance in the 1941-42 school year, before the influence of war was greatly felt, had been 25,839. It had declined to 21,828 in 1943-44, rose to 22,502 the following school year, and during this fiscal year the total was, in round figures, 22,770.

Family uncertainties growing out of shifts from war industry to other forms of employment were a factor in increased enrollment in nonreservation boarding schools, the daily attendance being 5,965 this year as against 5,500 during the previous year. Reservation boarding schools showed a slight decrease in attendance. Many Indian families, having lost wartime jobs, had not returned to the reservations and were wandering about the country. This uncertainty apparently was responsible for the failure of the Indian day schools to show a marked increase during this year. The daily average day school attendance this year was approximately 6,180 as against 6,086 the previous year and 7,870 during the 1941-42 school year.

Navajo Education

Efforts to meet the pressing educational needs of children on the vast Navajo Reservation were intensified during this fiscal year. The whole problem of Navajo education was being attacked. Population estimates, based on ration book distribution, indicated that there were at least 20,000 children of school age on the reservation. The Government provides facilities for teaching only 5,500.

There is room to accommodate 3,500 pupils in the day or community schools. The average daily attendance does not exceed 1,750. Maxi-

munum use has not been attained for several reasons. Roads for bus service have not been built in some areas. Also, bus service was made impossible in some places by the fact that road maintenance was largely discontinued during the war. Overcrowded Navajo boarding schools have cared for between 2,000 and 2,500 students although by accepted standards the dormitories are adequate for only 1,500.

During the current fiscal year, this difficult situation was further complicated by necessary abandonment of high-school dormitories at Shiprock, N. Mex., because of severe settlement in the walls; by abandonment of the entire school plant at Tohatchi, N. Mex., because of a break-down in the water and sewage distribution systems and the obsolescence of the dormitories; and by abandonment of half the school building at Chinle, Ariz., because of severe settlement of one side of the foundations.

Request was made for a supplement to the 1947 appropriation bill for funds to provide facilities to replace those abandoned at Shiprock and Tohatchi. The request was approved and added to the appropriation bill. Consequently, new dormitories will be built at Shiprock on a new site on the mesa north of the flood plain where the present buildings are located, and facilities for about 180 pupils will be provided at Toadlena, where there is ample water and no danger of flood, as a substitute for the abandoned Tohatchi facilities.

Navajos Demand Schooling

So active was the interest of the Navajos themselves in education, as well as in added health and other facilities, that a delegation of 26 men, including members of the tribal council, a war veteran, and interpreters, visited Washington, D. C., last May and appeared before the Indian Affairs Committees and appropriations subcommittees of the Senate and the House, the Secretary of the Interior, and representatives of the Budget Bureau dealing with Indian Affairs. The need of education was stressed by the delegation, for the Navajos had come to realize lack of education was a handicap to tribesmen in all activities, including making a living, when off the reservation. Also they had been disappointed because many of their young men had been rejected for military service because of illiteracy. The delegation made definite requests for added health and other facilities and stressed the necessity of compliance by the Government with the treaty of 1868 which had guaranteed a classroom and a teacher for every 30 children of school age. The delegation outlined a desired group of boarding schools to provide facilities for approximately 10,500 pupils and requested the Government to build them.

Public Interest Manifested

Active interest in the Navajo educational problem was also evidenced by chambers of commerce, service groups, church organizations, the Gen-

eral Federation of Women's Clubs, other women's organizations, state and local governmental agencies in Arizona and New Mexico, and the Indian welfare organizations. Two representatives each from the Arizona and New Mexico state departments of education conducted a week's survey of Navajo schools. They submitted a report discussing the need for new schools, the inability of the Government to operate all existing schools because of lack of teachers, irregularity of community school attendance due to bus service inadequacy, obsolescence of boarding school buildings, overcrowding of dormitories, and other inadequacies.

Excerpts from the report follow: "We found that much scientific study and research has been done to develop a curriculum to meet the needs of all pupils attending the schools * * * Well-chosen teaching materials have been provided for the teachers to enrich pupils' learning and aid in the development of accurate concepts about the world in which all people live. The curriculum corresponds very closely to that of many of the southwestern States, especially of the public schools of Arizona and New Mexico where there is a non-English speaking group to be considered * * * The Navajo schools are already serving as community centers, and there is an impressive adult participation in activities."

Complexity of the Problem

The Navajos consider education their paramount need, for they see the day as not far distant when thousands of their fast-growing population will leave the reservation, since its resources will not be able to support all of them. But the education problem is complex, for these are a nomadic people for the most part, following their flocks on a 16-million acre area, which is larger than the State of West Virginia. School sites must be selected and buildings erected to serve the needs of the greatest number. The types of schools must be determined, day schools where feasible and boarding schools where necessary. Roads must be built to transport the pupils to and from the schools.

It has been the endeavor of this Office to find the answer, and the effort will continue during the next fiscal year. As a supplement to the studies which have been and are being made, Dr. George I. Sanchez of the University of Texas, an authority on rural education, was commissioned to make a comprehensive survey during the summer of 1946. The results of these studies will be translated into added educational facilities as funds are made available.

Dearth of Teachers

The fiscal year of 1946 brought considerable difficulty in attracting teachers. That was partially due to uncertainty as to when the Civil Service would announce qualifying examinations for teaching positions and terminate the war service and temporary appointments held by a large

number of Indian Service teachers. Permanent public school positions, even at lower salaries, were more attractive to many than the uncertainty as to their remaining in the Federal service.

Schools in Alaska

Measures to improve opportunities for education of the Alaskan native peoples, the Indians, Eskimos and Aleuts, were also taken during the fiscal year. During the depression years the expansion of the day school and the boarding high school program in Alaska was brought almost to a halt. There are now approximately 2,600 of these children living in villages where there are no schools. Approximately 125 pupils, completing their studies in the 118 elementary day schools, could take advantage of an opportunity to attend the junior high school and later go on to senior high school if the facilities existed. Since Alaskan villages are small and distributed over wide areas, all secondary school education has been carried on in three boarding schools, Wrangell Institute in southeastern Alaska, Eklutna in the Cook Inlet area, and White Mountain on Seward Peninsula. There is immediate need for space for at least 200 more such students.

The war brought serious social changes to the native peoples of Alaska. War work which moved many Indians and Eskimos to installations of the armed forces, increased liquor consumption, and prostitution of some of the women, and the general displacement of many caused a great increase in juvenile dependency and delinquency. Many children were neglected by their parents and exposed to immoral conditions. With lack of paternal supervision, childish mischief often grew into serious delinquency. Only private institutions exist in Alaska for the care of dependent children.

During the fiscal year the Navy announced its intention of terminating activities at the Sitka Naval Base on Japonski Island near the town of Sitka, and the Congress authorized the Secretary of the Navy to transfer the property to the Department of the Interior for the use of the native peoples of Alaska. Plans were made to utilize the buildings at the base to conduct a 600-pupil boarding high school on the island.

On this basis, it has been planned then to utilize Wrangell Institute with its capacity of 200 and Eklutna with a capacity of 300 as elementary boarding schools, with White Mountain to continue as a high school for 70 Eskimo children. An average daily attendance of 400 was expected at the Sitka school during the first year of operation. This would include a limited number of elementary pupils from remote areas which have no day schools.

Health for Alaskan Native Peoples

Medical care for Indians, Eskimos and Aleuts of Alaska, which is inadequate at present, should be greatly improved through a program approved during this year. Particular attention has been paid to treatment of tuberculosis. The average annual death rate from tuberculosis during the past 7

years among these people in Alaska has been nearly 7 per thousand, and there is now but one sanatorium for tuberculosis, a 150-bed former Army hospital of temporary construction at Skagway.

After a comprehensive study the Federal Board of Hospitalization approved a program, recommending the acquisition of a 200-bed tuberculosis sanatorium in southeastern Alaska, a 300-bed tuberculosis sanatorium, plus 100 general medical and surgical beds, in the Anchorage area, and 60 general medical and surgical beds for northwestern Alaska, to replace existing unsatisfactory structures, and to establish additional beds at existing locations or at a new location.²

Funds were appropriated by the Congress for construction of the first unit, a modern 200-bed tuberculosis sanatorium on Japónski Island. Plans for its construction were initiated during the latter part of the 1946 fiscal year. A tuberculosis control unit composed of a medical officer, a public health nurse, a technician and a clerk will be equipped with a mobile X-ray and will conduct tuberculosis-finding programs among the various villages.

Scope of Health Service

Medical and surgical services accorded by the Indian Service in continental United States and Alaska during the fiscal year had an estimated value of not less than \$10,000,000. Seventy-six hospitals and sanatoriums, including 6 tuberculosis sanatoriums in the United States and 1 in Alaska, were operated. Supervision was given to 14 school health centers and to the activities of two hospitals operated by tribal funds. These institutions have a total bed capacity of 4,080, including 1,244 for tuberculosis. Care is also given at various State, county and private institutions under contracts with the Indian Service.

During the year 921,123 out-patient treatments were given to 558,201 individuals in hospitals and field dispensaries, and 39,582 patients were admitted to hospitals for a total of 820,267 in-patient days of treatment. Nearly one-fifth of the patients received major surgical treatment, and a large number had minor surgical care.

The serious shortage of physicians and nurses continued throughout the fiscal year with only slight relief. The nurse shortage was somewhat alleviated by utilization of senior cadets of the United States Cadet Nurse Corps in some of the hospitals. Some of the cadets, 136 of whom were graduated from courses in 10 Indian hospitals, will enter the Indian Service on a permanent basis.

Indian Cooperation in Health Measures

Education in measures of health protection and preservation have been continued with field nurses, education personnel and physicians taking

² The President approved the program Aug. 7, 1946.

an active part. In many places the Indians themselves are contributing much to the success of health educational measures by serving on health committees of tribal councils, and by other activities. Some of the tribes have adopted important health protective ordinances during the year. Some have passed resolutions favoring the adoption of complete health laws and regulations. These combined efforts seek to reduce communicable diseases and infant mortality and to improve personal hygiene, nutrition, and sanitation of the home and the community.

Tuberculosis continued to be prevalent among most of the tribes. Case-finding X-ray surveys were conducted on the Wind River Reservation, Wyo., Winnebago Reservation, Nebr., Crow Creek Reservation, S. Dak., and Pierre School, S. Dak. Increasing interest has been shown by Indians in these activities, according to reports.

Tuberculosis Prevention Study

Results were carefully analyzed of a study, begun in 1936, by which groups of Indians were given BCG (*Bacillus Calmette-Guerin*) vaccination to protect against tuberculosis. The procedure has proved of benefit, and it is planned to increase the number of those protected by extending vaccination to reservations with an unusually high tuberculosis morbidity.

The study group consisted of 3,007 persons, aged from 1 to 20 years. Of these, 1,550 were vaccinated, 1,457 were not. These persons were followed for 6 years with annual tuberculin tests and chest X-ray examinations. Results showed that BCG vaccination was associated with marked protection. Only four persons who had been vaccinated died of tuberculosis while 28 persons of the other group succumbed to the disease. Among those vaccinated, 40 contracted tuberculosis as against 185 in the other group.

Other Diseases Fought

Trachoma, an eye infection formerly prevalent among Indians, has been reduced to a low level of incidence. Reports now indicated that approximately 7.2 percent of all individuals examined have that infection. Cases discovered in routine school and clinic examinations are treated with sulfanilamide, the effectiveness of which as a remedy was discovered by the Indian Service medical staff.

The venereal diseases have decreased in prevalence in some areas and have increased in others. Penicillin, remarkably effective in the treatment of those diseases, is being used widely in Indian Service hospitals and clinics. In many areas Indians have been admitted to rapid treatment centers of State health departments for treatment of those diseases.

The year was notable for the absence of large epidemics of the communicable diseases, whooping cough, measles, chicken pox and influenza.

Those diseases occurred with less frequency than usual. A widespread program of vaccination was undertaken in Northwestern States and in Alaska when smallpox broke out in a virulent form at Seattle, Wash. So far as is known, the epidemic did not spread to Indian reservations.

Nurse Classification

Professional classification of nurses of the Indian Service has been requested in an effort to raise their salaries to an equivalent of those paid by other nurse-employing agencies and to promote morale by the additional prestige of a "professional" classification. At present field nurses, hospital staff, head nurses and chief nurses are classified in the subprofessional grade, whereas district and central office nurses alone enjoy the professional classification.

Use of Indian Lands

Just as the Indian Service, in partnership with Indian tribal and other organizations, acts to provide ever better health and education facilities, so does it assist the Indians to make the best use of their material resources to produce increasingly better livelihoods, and so does it protect their ownership of them.

Chief of these resources is land. This land belongs to the Indians—to individuals, tribes, bands, and other groups. It is held in trust for them by the Government but it nevertheless is the private property of the Indians. During this fiscal year and, in fact, in previous years, there have been indications of a growing concept in some places that Indian land and its oil, timber, minerals and other resources, are fair game for the taking. The Office of Indian Affairs has been vigilant to oppose any attempt to raid these resources. It repeatedly has made clear the fact that the Federal Government holds these resources as trustee for the Indian owners.

The Office of Indian Affairs has jurisdiction over land areas amounting roughly to 57 million acres, nearly all of which is held in trust for Indian tribes and individual Indians. Of this, approximately 31 million acres are classified as open grazing land and are valued at about \$90,000,000. Another 16 million acres are forest and woodlands worth about \$170,000,000, including the standing timber and reproduction and protection value. Approximately 7 million acres are agricultural lands, valued at \$100,000,000. Barren and waste lands comprise about 3 million acres. Alaskan lands are not included in those figures, because the process of determining and confirming Indian, Eskimo, and Aleut occupancy rights there has barely begun.

In general, the homes and buildings on these Indian lands are poor. They are estimated to be worth not more than \$15,000,000.

The land available for Indian use is insufficient in quantity and quality to support their entire population. About 7 million acres of the best lands

are practicably unusable by Indians because their ownership is scattered in small, undivided interests. During the war years no appropriations were made for land acquisition under the authority of the Indian Reorganization Act, and there was insufficient personnel to prosecute successfully the readjustment of the Indian land ownership pattern. Thus maladjustments multiplied during that period. Return of veterans and war workers to Indian lands complicated the task of providing sufficient land.

Inflated land prices throughout the country have resulted in a flood of applications to this Office for sales of Indian trust lands and patents in fee. Sales and the issuance of patents in fee have been limited to the lowest possible number since the total Indian land base is inadequate for their support on many reservations particularly those where land had been allotted to individuals in the past.

Land Acquisition

During the year, 236,790 acres, which formerly had been opened to the public for settlement, were restored to tribal ownership on the Uintah and Ouray Reservation, Utah. Those lands had not been settled because of their low grazing value and their distance from water.

Approximately \$203,000 of the Indians' own tribal funds were spent during the fiscal year to purchase about 49,000 acres on the following 13 reservations: Southern Ute, Colo.; Blackfeet, Flathead, and Fort Peck, Mont.; Consolidated Chippewa, Minn.; Navajo, N. Mex.; Seneca-Cayuga, Okla.; Warm Springs, Oreg.; Colville, Makah, and Tulalip, Wash.; and Wind River, Wyo.

The Indians of these and a number of other reservations are planning to carry on the land acquisition program, and have been authorized by the Congress to spend \$304,000 of their own tribal funds for the purpose. It should be noted that this expenditure will use up a large part, and in many cases all, of the tribal income, and that it is being done for the common good.

Many tribes have no income and must depend upon the Congress for appropriation of funds to acquire necessary lands. Under the authority of the Indian Reorganization Act, the Congress appropriated \$350,000 for the purchase of lands for needy Indians and returning Indian veterans for the 1947 fiscal year. This was the first such appropriation since 1942.

Tribal funds and those appropriated by the Congress will be used in the purchase of lands where Indians actually need and will use them. It will be good land in localities predominantly Indian where there is urgent need for improving the land ownership pattern. So far as possible, purchases will be limited to acquiring the badly fractionated heirship interests in the lands of old or otherwise incapacitated Indians and trust lands belonging to those who permanently reside outside of the reservations. Purchase and consolidation of heirship interests belonging to nonresidents will aid Indians

who can use the land, and at the same time aid the needy. Since complex heirship interests and allotments of nonresidents are not taxable, this will not take lands from State tax rolls.

Interest continued to grow on the allotted reservations for the return of scattered undivided equities in trust lands and trust allotments to ownership by the tribes in exchange for assignments granting life use of economic units of tribal lands, or shares in farming and grazing lands.

For five decades the ownership of Indian lands has become more complex because of the division of ownership through inheritance. The desire of the Indians to regroup their land holdings for better use reached a high point this year.

On the Rosebud Reservation in South Dakota, more than 20,000 acres were exchanged for shares in the Tribal Land Enterprise. Several hundred other applications for exchange were waiting action. This enterprise now manages nearly 60,000 acres and has continued to pay annual dividends of 4 percent to its shareholders.

At the Cheyenne River Reservation in South Dakota, Indians are continuing to convey their allotments and heirship interests to the tribe for exchange assignments. In this fiscal year, 336 full allotments and 325 partial allotments totaling 120,000 acres were so transferred. To date, nearly 300,000 acres have been returned to tribal ownership for exchange assignments on this reservation. In addition, many mutually advantageous exchanges have been made with non-Indians and with counties. The land ownership pattern thus has been greatly improved, and administrative costs and work have been lessened.

A number of other tribes have perfected land management enterprises. Operation of them will begin in the coming fiscal year.

Indian Lands for Military Purposes

During the war approximately 839,500 acres of Indian lands were used for air bases, gunnery and bombing ranges and other purposes related to the military program. Approximately 251,800 acres were sold by individual Indians. Of the balance, 556,800 acres and 30,900 acres of tribally owned land were used through lease and under permit, respectively. The lands are within the following localities or reservations: Alaska; Colorado River, Gila River, Walapai, and Papago Reservations, Ariz.; Palm Springs, Calif.; Fort Hall, Idaho; Blackfeet, Mont.; Carson and Western Shoshone, Nev.; Navajo and United Pueblos, N. Mex.; Five Civilized Tribes and Kiowa, Okla.; Pine Ridge and Cheyenne River, S. Dak.; and Klamath Agency, Oreg.

Surrender of homesites caused considerable hardship due to inability of many to find other desirable homesites at reasonable prices or, in fact, at any price. Surrender often was effected with the expectation that the lands would be returned to them after the war, especially since prices paid by

the Government were considerably less than the cost of acquiring comparable property elsewhere, particularly in view of the general increase in property values. Formal recommendation has been made for the return of these lands to Indian ownership, as released. However, to date none has been returned.

Indian Agricultural Income

Since the principal resource of Indians is the land, it follows that their chief source of income is from agriculture. Their largest single industry is cattle raising.

Comparative figures show the real progress which Indians have made as agriculturalists. In 1940 they sold an estimated \$9,124,000 worth of all agricultural products, and themselves consumed in the home approximately \$4,770,000 worth. In 1945, their sales amounted to about \$22,619,000, and the products consumed in the home were valued at approximately \$9,288,000. It is estimated that, after deduction of farm and livestock expenses, the net agricultural income, including home-consumed products, was in the neighborhood of \$21,898,000.

Growth of their livestock industry is demonstrated by the fact that in 1932 their income from sales of livestock and livestock products was less than \$1,300,000, whereas in 1945 they received \$16,376,000. During the latter year the eight reservations in Montana and Wyoming alone produced and marketed 9,224,584 pounds of dressed beef, 3,280,200 pounds of dressed lamb and mutton, 332,550 pounds of dressed pork.

Part of the increase in Indian agricultural income is due to improved economic conditions. Increased activity, however, accounts for much improvement. Technical and financial assistance is furnished by the Indian Service for these activities which produce income for the Indians.

Credit for Indians

Lack of capital long hindered the Indians in their efforts to be really self-supporting. A revolving credit fund established by the Indian Reorganization Act of 1934 provided the necessary capital they lacked prior to that time. As money is repaid by borrowers, the principal and the interest payments revert to the original fund and are available for additional loans.

As of June 30, 1945, loans totaling \$6,614,000 had been made from the credit fund. That figure includes loans from moneys appropriated and from money repaid by Indian borrowers. Since repayments cannot be made unless the enterprises financed are successful, some indication of the utility of the system may be gained from the fact that repayments of \$3,279,640 have been made. Only a meager sum, \$14,459, is currently past due. The due dates on loans totaling \$251,929 have been advanced through refinancing. Losses to date have amounted to \$2,746. It must

be remembered, however, that the past 5 years have been ones of increasing prices, and that, to some extent, has influenced the phenomenally successful operation of the credit fund.

Supplementing revolving credit funds, the Congress has authorized the use of tribal funds totaling \$3,529,898.

Credit Without Money

Still another type of credit, which is unique in the Indian Service, calls for repayment "in kind." Some of the cattle purchased by the Government from distressed stockmen as a relief measure during the drought years in the thirties were turned over to the Indian Service. These were transferred to Indians who had feed and range available. They signed contracts to repay one animal for each received. Those which were repaid were loaned to other Indians similarly.

This program has been participated in by 12,718 Indians. A total of 42,717 animals are owed to the United States as of December 31, 1945. The revolving feature of the program is illustrated by the fact that 67,629 head have been repaid since the system was initiated.

Effects of Credit

The needed capital, as well as instruction and aid by Indian Service experts, and better economic conditions have helped the Indians greatly to increase their assets and thus attain a higher standard of living. Better livestock has been acquired, its quality has been improved, and the Indians have increased feed production to maintain their animals. Repayment schedules convinced many that to meet the due dates they often must cut down living expenses, which could be reduced by growing gardens. So more garden produce was raised.

Studies made this year disclosed many instances of Indians aided by a little capital, which meant to them the difference between poverty and a comfortable living. One may be cited.

In the spring of 1941, a 39-year-old Indian was granted an assignment of land by an Indian band. He had spent the greater part of his life as a roustabout for non-Indian ranchers, on highway jobs, PWA, and odd jobs generally. Sometimes he earned a little by trapping coyotes.

When he arrived at his land assignment his total assets were 34 cents, a horse and a saddle, but he knew what he wanted. He worked hard, repairing fences, irrigating hay land, harvesting hay, and doing other necessary jobs. He borrowed \$1,500 from the revolving credit fund and purchased livestock and equipment. A checkup in the fall of 1945 showed that he had tripled the number of his cattle, had an agricultural income of \$1,274, had 66 head of cattle, and other property valued at \$2,712. He had reduced his indebtedness to \$510 and had a net worth of \$6,664.

Shortly after going to his assignment he married. His wife also had an assignment. They kept their cattle on an individual basis, but the combined net worth of the couple was \$11,722 last fall.

Indian Response to Food Crisis

Numerous Indian tribes this spring recognized the world-wide need for food to feed the distressed people of other lands. The following statement of the Coeur d'Alene Indians of the Northern Idaho Agency is typical of their action: "Because of the very urgent need for an additional food supply for ourselves and the world at large, we hereby pledge to use all available means to have the Coeur d'Alene Indians produce all the additional food that is possible."

In 1945 farms operated by the Indians produced field crops, including forage, grains, and vegetables, with a gross value of \$12,845,000. The products which they sold brought them approximately \$5,174,000. Home-consumed food was valued at \$851,520. Much of the forage and cereal grains was fed to their own livestock.

4-H Club Work

Indian youth have taken an active interest in 4-H Club work, which supplemented classroom work with instruction and practical experience in agriculture and home-making. There were 597 of these clubs in 1945, with a total membership of 2,189 boys and 2,595 girls. County prizes were won by 760 of them, and state prizes by 26. The total estimated value of all Indian 4-H Club products was \$173,991.

Indian Forests

Indian forests during the calendar year 1945 continued to supply a large amount of timber for war and reconversion purposes. A total of 2,661,873,00 feet was cut during the fiscal year of 1941 and the 4 war years, 1942-45.

The 1945 cut was 475,662,000 feet as against 528,472,000 feet the previous year. The reduction was due in large part to labor strife in the lumber industry following the end of the war.

Indian sawmill operations on the Menominee, Red Lake, Navajo, and Fort Apache Reservations produced approximately 29,218,000 feet of lumber during the fiscal year of 1946.

White pine blister rust control continued during the year in cooperation with the Bureau of Entomology and Plant Quarantine of the Department of Agriculture. Initial eradication work has been performed on 83,307 acres, and 51,436 acres have been reworked, in the white pine control areas located principally in the Lake States.

During 1945, there were 973 forest fires on Indian lands, burning 118,-833 acres. This was somewhat lower than the annual average of 998 fires during the war years, beginning in 1942. Indian forests totaling 39,685,-561 acres were under fire protection in 1945, at a cost of only \$238,512. The Indians are indeed fortunate that the losses have been so small with the limited amount of fire protection funds available.

Grazing

During the calendar year 1945 approximately 44 million acres of forest and open range lands were grazed, providing forage for about 9 million cattle months. Of this area approximately 34 million acres were grazed by Indian livestock. The cash receipts for grazing privileges were approximately \$2,098,000. The value of free use to Indians was about \$887,000.

Full use of the range was maintained during the year consistent with the principles of conservation, except in the Southwest. Continued difficulty was experienced with overstocking in this area where a severe drought has further complicated a serious problem. Since the range lands of a number of the Southwest reservations will not support a sufficient number of livestock to provide a reasonable standard of living, reductions to grazing capacities have proceeded slowly. Progress, however, is being made in spite of difficulties.

Fish and Game

The taking of fish, wild game, and furs and skins, continued to be of considerable importance in the economic welfare of the Indians both for domestic use and for commercial purposes. Exclusive of Alaska, the 1945 take by Indians consisted of 5 million pounds of fish, 1 million pounds of game and over 60,000 furs and skins with a total over-all value in excess of \$1,250,000. Almost all of the big game was for home consumption, but commercial fishing has developed into important enterprises on several reservations, and over 4 million pounds of fish were sold last year.

Several tribes are showing significant interest in wildlife conservation and are seeking ways to increase their wildlife resources. Indian Service encouragement and assistance in wildlife development and management should be extended to improve these valuable resources.

Oil on Indian Lands

Oil and gas prospecting and leasing activity on Indian lands, kept at a high rate by military requirements for petroleum throughout the period of the war, has shown no sign of slackening with the termination of hostilities. Postwar domestic and world demand has exceeded estimates, and though production has been approaching the wartime peak, the search for new reserves continues apace.

Forty-one lease sales were held during the fiscal year, resulting in the sale of 1,082 in the midcontinent area, 13 leases in Arizona, New Mexico, and Colorado in the southwestern area, and 16 leases in Montana, Wyoming, and Utah in the Rocky Mountain area.

Some of the major developments of the year in exploration of Indian lands were the deep drilling projects in the Anadarko Basin in Oklahoma, extensive activity on the Uintah and Ouray lands in the Uintah Basin in Utah, where approximately 20 geological and geophysical survey crews were active, a vigorous exploratory play in the San Juan Basin of New Mexico, Utah, and Colorado, and Madison lime pool development in the Cut Bank Field, Mont. Wildcat leases were approved covering unexplored areas on Mississippi Choctaw lands in Mississippi, and allotted lands of the Quinaielt Reservation, Wash., where test wells are to be drilled during the coming year. Special prospecting permits with rights of lease selection, covering some 300,000 acres on the Wind River Reservation, Wyo., and the Laguna Pueblo, N. Mex., where sold at competitive bidding.

Production from the thousands of stripper wells on Indian lands in Oklahoma was supported by the 35 cents a barrel subsidy payment. Petroleum price controls were continued throughout the fiscal year but ended at the close of the year. Prices then advanced 25 cents a barrel in most areas.

A new 8-inch, 32-mile high pressure natural gas pipe line is being laid to serve the isolated Barker Creek Dome high pressure wells on the Ute Mountain lands in Colorado. Shipment of oil started from a new discovery on the Sheldon Dome, Wind River Reservation, Wyo.

Statistics follow:

Number of leases in force at end of year.....	6,602
Total acreage leased during the year.....	169,442
Total acreage under lease at end of the year.....	1,759,040
Number of producing oil wells drilled during the year.....	222
Number of producing gas wells drilled during the year.....	25
Number of dry holes completed during the year.....	118
Total number of producing oil wells at end of year.....	11,393
Total number of producing gas wells at end of year.....	480
Gross oil production for the year.....barrels...	21,607,310
Income to Indian owners from oil and gas leases during the year.....	\$6,148,518

Mining

A total of 51 mining leases, other than oil and gas, were issued during the year. The following leases and permits were in force at end of year (not including numerous sand and gravel permits): Vanadium, 8; vermionulite, 1; pumice, 5; limestone, 11; lead and zinc, 40; coal, 79; gypsum, 4; tungsten, 3; gold-silver, 3; copper, 3; asphalt, 5; asbestos, 4; manganese, 6; and black sand tailings, 1, totaling 173.

Royalty, rental and bonus income received by Indian owners during the fiscal year amounted to \$564,938.

Irrigation

The demand for irrigation on Indian lands has been increased by the return of Indians from military service and from war work. During the war years the irrigation systems on Indian reservations, in common with other irrigation projects, were operated to meet demands for food production rather than for the future needs of the systems. That program was made necessary by sacrifices of manpower, vital construction materials, and equipment. The more permanent types of maintenance often were neglected. Rehabilitation of irrigation systems, completion or extension of existing systems and surveys looking toward development of all irrigable Indian lands are elements of the postwar program.

About 535,000 acres on more than 250 Indian Service projects were irrigated during the calendar year of 1945. During that year those lands, including Indian lands operated by Indians or leased by them to other persons, and non-Indian-owned lands, produced crops valued at more than \$32,000,000, which was approximately one-half the total cost of construction of the projects involved and which was \$1,500,000 greater than the 1944 crop value.

Because of the drought in the southwestern area and consequent deficiency in water supplies, the area irrigated was reduced by about 4,000 acres on the San Carlos project in Arizona and by about 3,000 acres elsewhere in that State. The Flathead project in Montana, however, reported an increase of 3,000 acres.

Indian irrigation projects vary in size from 2 or 3 acres to such major projects as the Flathead, the San Carlos, and the Wapato in Washington, with designated irrigable areas of 100,000 acres or more. The smaller units are generally subsistence gardens which supplement wages by production of table foods, or, when livestock is the principal economy of the reservation, can be used to produce supplemental winter feed.

With the exception of 50,000 acres of non-Indian lands on the San Carlos project, which are operated by an irrigation and drainage district, Indian irrigation projects are operated and maintained by the Indian Service. Some of the smaller units are operated and maintained by the Indians themselves without assistance from the Government except for general supervision.

Soil and Moisture Conservation

Soil and moisture conservation operations were conducted on Indian lands during the year to the full extent of the limited funds and facilities. The demand for expert aid in conserving the soil far exceeded the ability of the Service to provide it.

Land use plans were made during the year on 60 project areas for 1,200 farm and range units, comprising an aggregate of 1,528,000 acres. A total

of 2,694 farms were protected by contours, terraces, stripping, cover crops, improved pastures, better rotations and land use, prior to and during the war. That, however, is a small part of the approximately 78,500 farm and range units on Indian lands to be protected from increasing erosion and soil wastage.

Indian lands in common with other lands have been used unwisely, but interest in soil and moisture conservation has increased. Limited funds have been insufficient for Indian Service cooperation with many soil conservation districts, organized under the laws of the various States. Superintendents of many Indian reservations have been requested by local bodies to aid in the common problem.

Where possible, the Indian Service furnishes technical assistance to conserve Indian lands, and the operators of the lands do the work. In many instances Indians who rent their lands are insisting that the operators employ conservation practices.

Some Indian farmers with the most rudimentary equipment are practicing conservation. A unique feature of work being done by 69 Cherokee war veterans in North Carolina is the establishment and improvement of productive and protective pasture cover by hand seeding and hand fertilization on mountain slopes so steep that animal or tractor-drawn implements cannot be used. The Choctaw Indians in Mississippi are terracing, strip cropping, making sodded waterways, fertilizing and improving pastures, and carrying out a program of progressive conservation farming, usually with no more than mules and simple farm equipment.

An operation on the Nez Perce and Coeur d'Alene Reservations in Idaho illustrates the value of such programs. Land use plans on 252 farms brought about the use of sweet clover, instead of clean fallow, between wheat crops, adding surface protection, nitrogen and organic material. The result was a wheat yield on 8,700 acres which was 100,000 bushels greater than that of last season. Application of complete conservation plans on 534 farms in Oklahoma increased returns by an estimated \$70,000 during 1945.

Ultraextensive soil surveys and land classification in the great plains area have enabled the Indian Service to provide 899,750 acres for the production of much-needed additional wheat and flax. They also served to forestall a repetition of injudicious use and land destruction which followed the promiscuous breaking of sod land during World War I.

In the Southwest, spreading of flood water on 72,220 acres has contributed to increased forage production and the reduction of siltation in reservoirs. Accomplishments on 60 Indian Service projects include: Brush control, 1,663 acres; canals, 65 miles, gully checks, 282; contouring, 66,240 acres; cover crops, 36,500 acres; crop improvement, 4,000 acres; crop residue culture, 17,720 acres; dams, diversions and ponds, 611; dikes and levees, 648 miles; drainage, 5,760 acres; drops and turnouts, 1,115;

fencing, 276 miles; field laterals, 25 miles; gully control, 80 miles; commercial fertilizer, 4,980 acres; jetties, 790; soil survey and land classification, 1,462,600 acres; land levelling, 335 acres; liming, 1,510 acres; barnyard manuring, 3,700 acres; meadow strips, 170 acres; pasture mowing, 7,460 acres; shaped and sodded terrace outlets and watercourses, 41 miles; pasture and meadow renovation, 4,330 acres; pest and rodent control, 20,000 acres; rotations, 886,000 acres; rough tillage, 45,500 acres; seed grown and collected, 4.3 tons; seeding and planting, 11,900 acres; spring developments, 28; ponds stocked with fish, 35; streambank protection, 8 miles; strip cropping, 7,080 acres; farm terraces, 228 miles; trees and plants grown, 214,000; planted 192,691; waterspreading, 83,875 acres, and 47 wells developed for livestock water.

Reseeding by Airplane

A novel experiment in reseeded by airplane selected Indian lands in Arizona with hardy grasses was begun during this fiscal year in cooperation with the Office of Land Utilization. Areas totaling 50,000 acres, where the natural vegetative cover had been impaired, were chosen. Results, which are being watched throughout the Southwest, should be seen during the 1947 fiscal year.

Arrangements were made with a contractor to reseed 10,000 acres on the Papago Reservation, 20,000 acres on the San Carlos Reservation, and 20,000 acres on the Hopi and Navajo Reservations. Work on the Papago was completed in June 1946 and operations on the other reservations were planned for the following months.

On the Papago Reservation seeds of Lehmann's lovegrass and of sand dropseed were used. These were encased in pea-sized pellets of clay with a binder. Also contained in the pellets were tiny amounts of fertilizer and of chemicals to repel rodents and insects. These were scattered by a rotor device in the airplane in accordance with an established pattern of one pellet per square foot. Moisture dissolves the pellets, freeing the seed and permitting it to germinate and the grass to grow when climatic conditions are right. Reseeding costs approximately \$1.98 per acre.

Grasses are chosen for their suitability to the land. Lehmann's lovegrass, sand dropseed and western wheat were selected for the San Carlos land, and those, plus crested wheat and weeping lovegrass, for the Hopi and Navajo areas.

Reservation Roads

Maintenance of the roads which are essential to the economy, health, education and welfare of Indians resident on the reservations was stressed during this year. There was some work on access roads which had made a valuable contribution to the war effort by providing a way of bringing out timber, oil and rare minerals.

The Indian road system had suffered much deterioration due to lack of funds and equipment to maintain it in wartime. It is estimated that even if sufficient funds become available it will require several years to bring the roads back to a reasonable state of repair. The major part of postwar road work on Indian reservations will be reconstruction of important roads which are beyond ordinary repair, and the heavy maintenance needed to make the whole system serviceable. There are nearly 20,000 miles of roads and trails on the reservations.

During the past year extreme flood conditions caused much damage to roads in various locations.

Construction

The physical plant of the Indian Service, exclusive of irrigation works, roads and sidewalks, is valued at approximately \$60,000,000, representing buildings of all kinds, utility services and communication facilities. The present-day replacement value of the physical plant probably would be about \$120,000,000.

Since the end of hostilities, as during the war years, no major construction work has been undertaken, only urgent maintenance work to keep the existing plant in reasonable operation being done. As the result there is a large backlog of needed construction, consisting of education, medical and general administration buildings, water, sewer, heating, electric and telephone facilities, and a large amount of urgent maintenance.

Indian Arts and Crafts

Indian crafts products suffered a diminution in quantity and quality during the war years because many craftsmen were in the armed forces or in war work, and because of the shortages in leather, beads, silver, wools and yarn. Through the efforts of the Indian Arts and Crafts Board, however, special regulations were made to provide materials for craftsmen dependent on such handwork for their livings.

During the past year although craftsmen have been returning to the reservations, resumption of craftwork has been slow both because of a natural tendency of many to relax from the strain of war and because shortages in materials continued. Only dribbles of silver reached Indians and Indian traders of the Southwest. Turquoise remained exceedingly scarce.

Nevertheless, the major Indian craft enterprises continued, some with increases, some with reduced production. On the basis of incomplete reports, sales of cooperative Indian enterprises showed a total of \$492,525 in 1944 and \$353,213 in 1945.

The largest slump was found in sales of Alaska crafts, including those of the Nome skin sewers. The figure was \$420,200 in 1944, and \$263,582

in 1945. Native crafts in Alaska during the war found a huge market because of the presence of the armed forces and others who were ready buyers. Business now is returning to normal.

Welfare

Continuing its emphasis this year on programs designed to make Indians self-supporting through their own efforts, the Indian Service yet was obliged to make relief grants to families unable to earn their own livelihoods. The problem increased as the armed forces' dependency allotments and wartime employment ceased.

Special welfare aid was given, also. Social service assignments during the year included the placement of a worker on the Colorado River Reservation in Arizona to assist in the colonization program there. Case work service for children as well as adults and participation in planning community projects during the period of adjustment were continued.

A social worker also was assigned to the Missouri Basin survey to plan with families to meet the problems which will arise in moving to new home sites when the old are flooded by the building of dams. These services are to continue during the removal and the period of adjustment to new environments.

Income, such as rentals and royalties, derived by Indians from their trust land is regarded as restricted funds, and is made available to them on application to agency superintendents within certain limitations specified in regulations of the Secretary of the Interior governing expenditure of these "individual Indian moneys." By reason of changed conditions and the progress made by Indians it has been determined that more authority should be delegated to superintendents to act in matters of that kind so that this phase of Indian administration may be handled more expeditiously. As the result of a study conducted by the Indian Service, consideration is being given to modification of both the general and special regulations as applied to certain jurisdictions.

The task of maintaining law and order on the reservations continued to be an important phase of Indian administration. It was made the more difficult by a sizeable turnover of Indian police and judges because of the low salaries paid. Salaries range from \$600 to \$1,200 a year for Indian police and from \$180 to \$360 for judges. Maintenance of law and order bears directly on the progress made by Indian people.

On May 31, 1946, a law was adopted conferring upon the State of North Dakota jurisdiction over offenses committed by or against Indians on the Devils Lake Reservation in that State. Similar legislation as applied to the reservations in Kansas previously had been enacted. Consideration is being given to the possibility of general legislation to confer such jurisdiction upon States if the Indians of any reservation vote to accept it.

Considerable interest in legislation of this character is being manifested by Indians in various parts of the country, but particularly in Wisconsin, Minnesota, and California.

Tribal Government

Considerable progress in self-government was made during the year by Indian tribes, many of which have government bodies under the Indian Reorganization Act of 1934, the Oklahoma Indian Welfare Act, the Alaska Act, and otherwise. Returning veterans already have become members and officers of some tribal councils.

A total of 181 tribes or bands accepted the Indian Reorganization Act within the 2 years after its passage, 77 tribes rejected it, and 14 other eligible groups did not vote on it. Of the 181 who accepted the act, 92 tribes, bands, or Indian communities have adopted constitutions under the act. In Oklahoma 18 tribes have organized pursuant to the Oklahoma Indian Welfare Act.

Groups with constitutions under the Indian Reorganization Act are entitled to charters issued by the Secretary of the Interior. These charters contain provisions that, after given periods of time, certain specified administrative powers reserved by the charters to the Secretary may be terminated upon vote of the members. Most of the periods are for 10 years, some for 5. The 5-year period in 11 charters has expired, and the 10-year period expired in one instance this year. Others will expire in the fiscal year of 1947. During the 1946 fiscal year one tribal governing body proposed to submit to a vote the question of terminating the powers mentioned, but the proposal was premature since the charter had not been in effect the required 10 years at that date. A survey of the agencies having jurisdiction over the tribes indicated that in many cases only modification of the secretarial supervision was desired.

During the year the Nisqually Indian Community in Washington drafted a constitution. An election has been called to permit a vote as to its acceptance.

Several tribes during the year found it advisable to amend their constitutions and bylaws. The Walker River Paiute Tribe, for instance, adopted an amendment authorizing the tribal council to regulate domestic relations among tribal members and to administer law and order by establishing a reservation court. Other groups which made amendments were the Blackfeet and Southern Ute tribes and the Gila River-Maricopa Indian Community.

Many of the tribes which rejected the Indian Reorganization Act found themselves in need of acting as organized units. The Indian Office has encouraged adoption of constitutions or other organization to provide for a representative governing body. During the year constitutional committees of the Nez Perce Tribe in Idaho and the Sisseton-Wahpeton Sioux

Tribe in South Dakota drafted new constitutions. Nez Perce Tribe members rejected theirs, and the other tribe had not yet held an election.

A total of 133 tribes have been incorporated under the Indian Reorganization Act, the Oklahoma Indian Welfare Act, and the Alaska Act. The Salt River Pima-Maricopa Indian Community and the Havasupai Tribe have requested charters of incorporation during the year. In Alaska, 48 native villages have completed organization under the Alaska Act, which extended the Indian Reorganization Act to Alaska. During the year the villages of Deering and Point Lay adopted constitutions and charters. The villages of Kojuk, Napakiak, and Shungnak drafted constitutions whereupon charters were issued. Elections have been called to determine whether they should be adopted.

Veterans Participate

War veterans have taken an active interest in tribal affairs. All the officers of the Crow Creek Tribal Council and the secretary of the Pine Ridge Tribal Council, both in South Dakota, are veterans of World War II.

For the first time in the history of the Osage Tribe in Oklahoma, the privilege of voting by mail in the tribal election was granted to all qualified voters, although in 1942 persons in the armed forces were so privileged. A large number of absentee votes was reported as having been cast in the June 3, 1946, election.

Indian Claims Commission

This year the prospect was bright for the establishment of an Indian Claims Commission to hear and determine the many unsettled Indian tribal claims against the United States. Legislation for that purpose has been sought for more than a decade by the Office of Indian Affairs and the Department of the Interior.

Those claims, based upon alleged treaty violations and other causes, had accumulated over a period of 4 score years. The situation was caused by a law passed in 1863 when various tribes were engaged in hostilities against the United States. The law barred Indians from suing in the Court of Claims. Since then, no claim could be brought without special act of Congress. The discrimination caused a deep-seated sense of grievance. The procedure made long delay. Many Indian groups never had their day in court.

A bill (H. R. 4497) to create a three-man Indian Claims Commission was being considered by the Congress. All claims existing prior to approval of the bill would be heard and determined within 10 years by the commission, which would then cease to exist. Claims must be filed within 5 years or be outlawed. Indian tribes, bands or groups could file new claims in the Court of Claims. Claims previously before the Court of

Claims would be determined by that court. The findings of the Indian Claims Commission would be reported to the Congress which would appropriate moneys to pay any final determinations.⁸

Old Indian Claim Paid

By an act approved June 28, 1946, the Congress authorized appropriation of \$400,000 "in full and final settlement of the claims of the Indians of Fort Berthold Indian Reservation in North Dakota." The Arickaree, Gros Ventre, and Mandan Indians of that reservation had sought recovery of the money for more than 10 years.

The claim arose from circumstances subsequent to a treaty those tribes made July 27, 1866, with the United States. The treaty provided they should receive \$20,000 annually for 20 years. The treaty was never ratified, but the money was paid.

In accordance with a law passed in 1920, those tribes prosecuted various claims before the Court of Claims. The court awarded a net judgment of \$2,169,168.58, after making various offsets, one of which was the \$400,000. The Indians asserted the offset was made erroneously and that its effect was to deprive them of payment for certain land ceded to the Government under the 1866 treaty.

The Office of Indian Affairs and the Department of the Interior favored enactment of the bill to restore the \$400,000 to the Indians, taking the position that, because the treaty was not ratified, the Indians had no legal claim, but that they did have a strong moral claim.

Indian Lands in Missouri Basin

The inter-agency plan for the development of the Missouri River Basin blankets the traditional homeland of the Plains tribes. Twenty-one Indian reservations, having a total of 15 million acres, lie within the seven basin States, particularly in North and South Dakota, Montana, and Wyoming.

A number of projects involve the taking of substantial acreages of Indian lands, while others potentially confer substantial benefits in the development of Indian resources. In time all Indian lands and their owners will feel the economic impact of the plan's full realization.

In the fiscal year 1946 the Office of Indian Affairs took initial steps to bring the vital interests of the Indians into the total interagency planning of Basin development. Over-all basin surveys and certain preliminary engineering studies were undertaken. The proposed construction of the Garrison Dam and Reservoir in North Dakota by the Corps of Engineers, United States Army, occupied a good deal of attention during the year.

⁸ The President signed H. R. 4497 on Aug. 13, 1946.

When substantial funds became actually available toward the end of the fiscal year a special unit, the Missouri River Basin investigations unit, was organized with responsibility for conducting the necessary surveys and studies of Indian lands in the basin.

Fort Garrison Dam

The Fort Garrison Dam and Reservoir, a multipurpose project on the main stem of the Missouri River, will involve an area of 145,000 acres on the Fort Berthold Indian Reservation, necessitating the removal and rehabilitation of approximately three-fourths of the resident Indian population. During the fiscal year the War Department and the Department of the Interior, through the Corps of Engineers and the Office of Indian Affairs, respectively, conducted numerous conferences as to the method and means of compensating the Indians for their losses. Section 6 of the 1947 Civil Functions Appropriations Act of the War Department, approved May 2, 1946, requires the Secretary of War to select and offer to the Fort Berthold Indians through the Secretary of the Interior substitute lands of comparable quality and sufficient area to compensate them for the lands to be flooded. The offer of lieu lands must be made prior to January 1, 1947.

The execution of this congressional mandate necessitated the initiation of numerous surveys which were being organized at the end of the fiscal year. During the course of the year, however, preliminary investigations and findings were made as to replacement costs of buildings and improvements on the area to be inundated and as to the original cost of Indian Service roads on the reservation. A preliminary engineering study to determine the damage to Indian land owners arising from the inundation of their potentially irrigable lands, and a reconnaissance of the reservation economy and social organization were made also.

The Three Affiliated Tribes of the Fort Berthold Reservation have consistently opposed the construction of the Garrison Dam at the proposed site. In a resolution dated May 25, 1946, the tribal business council offered an alternate site for construction of a dam with a lower storage capacity at a point about 6 miles south of Sanish near the northern boundary of the reservation. The resolution offered that site free of all cost to the Government.

Possessory Rights in Alaska

A start on the settlement of the aboriginal rights of Alaskan native peoples was made when Harold L. Ickes, then Secretary of the Interior, ruled on claims made by the Indians of Hydaburg, Klawock, and Kake, villages in southeastern Alaska, to exclusive use and occupancy of certain land and water rights. He concluded that the policy of recognizing aboriginal pos-

sessory rights, where native possession had been continuous and exclusive, applies in Alaska as it does in the States of the United States.

His order, promulgated July 27, 1945, recognized as valid the claims of the Indians of the three villages to approximately 8 percent of the area claimed. The decision gave them continued use and occupancy of land areas totaling approximately 273,000 acres, together with rocks and islets within 3,000 feet of the shore and including all inlets where the distance from shore to shore is less than 1,000 feet, all streams, and the waters within 500 yards of the mouth of each stream as defined pursuant to the act of April 16, 1934.

Although the exclusive use and occupancy of the remaining area claimed was denied, the decision recognized that within the area claimed respectively by each of the three groups, the members had continued to use existing trails and waterways, and to hunt, fish, trap, and gather natural resources in common with all other citizens, subject to applicable conservation measures. A decision on the areas totaling approximately 2,008,000 acres, including all of Kuiu Island, claimed by the Indians of Kake in common with all other bands of the Tlingit Tribe, was reserved for future determination. Claim to exclusive rights to the use of certain open ocean waters was rejected.

The petitioning natives and also the protestants asked a rehearing, which was held. On the basis of additional evidence, the Secretary on January 11, 1946, ruled that a number of small tracts amounting to not more than 800 acres in the aggregate had been continued to be used and claimed exclusively by the native groups, but that native rights had been extinguished in areas amounting to 1,120 acres, used for canning facilities, with the acquiescence of the natives.

Field work was done during this fiscal year for the purpose of making a report on the claims of other native villages of southeastern Alaska which had petitioned to have their possessory rights determined.

Reservations in Alaska

Toward the close of the fiscal year several villages in Alaska unanimously asked the Commissioner of Indian Affairs and the Secretary of the Interior to establish reservations for them. These villages included Klawock and Kasaan in southeastern Alaska and Northway and Tanacross in the interior.

Fish Trap Sites

The native peoples of Alaska have a vital interest in the commercial fishing regulations, in obtaining fish trap sites, and in protecting their fishing rights in waters off their established reservations.

They were represented at hearings held in February 1946 in Washington, D. C., to consider proposed regulations limiting the number of trap

sites to be operated by any one person or corporation and granting preference in the allocation of excess trap sites to residents of Alaska, native and nonnative alike. They plan to participate in hearings to be held in Alaska at some future date to give Alaskans an opportunity to voice their views on those questions.

Waters off Karluk Reservation on Kodiak Island had been closed by the Secretary of the Interior to fishing by others than the natives residing there or to persons authorized by them. Toward the end of the fiscal year suit was filed in Federal Court in Alaska by a group of packing companies contesting the validity of the regulation and seeking to enjoin the Fish and Wildlife Service from enforcing it. The court issued a temporary restraining order. This litigation will be pursued.

Indian Suffrage

The Navajo delegation in Washington last spring stressed the desire of the Indians of Arizona and New Mexico to vote. The legal ban against their right to suffrage in those states has caused many protests from Indians and non-Indians alike during this fiscal year. Veterans of World War II particularly have objected.

Indian citizens almost anywhere else are not refused the vote by reason of the fact that they are Indians. In Arizona, however, the State constitution has been interpreted so as to deny the vote to Indians as being "persons under guardianship." The constitution of New Mexico refuses suffrage to "Indians not taxed."

The Office of Indian Affairs long has taken the stand that suffrage is the right of Indian citizens just as it is of other American citizens.

Indian Liquor Legislation

In May of this year a bill (S. 2159) sponsored by the Office of Indian Affairs and the Department of the Interior, was introduced. It would permit the sale or gift of liquor to Indians outside the Indian reservations. It would do nothing to disturb the law against possession or use of intoxicating beverages on the reservations, where no one, Indian or non-Indian, may possess them legally.

A special Indian liquor law was first passed more than a century ago at the request of the Indians to protect them from the extortion, cupidity and avarice of white traders. Spirituous liquor often was used to debauch the Indians. Other laws followed, for the protection of the Indians.

Conditions have changed greatly since those days. Many Indians have been acculturated to the white man's civilization. Indians feel that the prohibition which singles them out as a racial group is discriminatory and brands them as inferior. Veterans of World War II, who were able to obtain liquor without difficulty while in the armed forces, have made many

protests against the existence of the law. Various Indians tribes have passed resolutions urging that sale of liquor be permitted to Indians off the reservations.

Menominee Swampland

Notification November 21, 1945, to the Secretary of the Interior by the Attorney General that the United States had acquired title to 33,870.23 acres of swampland in trust for the Indians of the Menominee Reservation, Wis., was the final step in settling a land dispute 90 years old.

The United States had established a reservation, including the swamp-land, for the Menominees by a treaty in 1854. But the State of Wisconsin claimed earlier ownership of the land under the Swampland Act of 1850. Litigation ensued. The State's claim was upheld. Then the Court of Claims decided the United States owed the Indians for the land they did not get. But the Indians, who conduct a sizable lumber industry, preferred the land to the money. So the United States bought the land from the State, paying a certified Treasury check for \$1,590,854.50. Now the Government holds the swampland in trust for the Indians.

Sioux Pony Claims

Work proceeded during the year in tracing the heirs of more than 1,000 Sioux Indians who will receive payment for ponies or other personal property taken from their ancestors by military forces in 1876 during the Sioux wars. Toward the close of the year payments were about to be made to the only three living claimants then found, aged Sioux who were young when the soldiers took their ponies. They are: Bear with Black Body, 93 years old, of the Cheyenne River Reservation, and Daniel Grass Rope, 84, and the Reverend Ben Brave, 81, both of the Lower Brule Reservation. Both reservations are in South Dakota.

Payments are being made from a fund of \$101,630 provided for the purpose. Because of the time which has elapsed, the task of tracing so many heirs or successors in interest has been a time-consuming one. At the end of the year, however, 47 cases had been received, and cases were being received from the field in increasing numbers.

Payments are supplemental to partial payments made in the decade beginning with 1890 when appropriations made were not sufficient to pay the claims in full. Ponies had been taken by the military from friendly and neutral Indians as well as from the hostiles. Under present law, only those Indians who were not hostile then or their descendants may receive payments now.

War Veterans in the Indian Service

As of June 30, 1946, the Indian Service was employing 1,169 World War II veterans, both Indian and non-Indians, including 1,053 men and 116

women. Of these 841 were employees who had returned from military furlough and 328 were persons who had not been employed by the Indian Service prior to the war.

More than 1,300 persons in the Indian Service entered the armed forces. Twenty-one of the men and three women died in the service of their country. Many were wounded in action. A number won military decorations. Two men survived more than 3 years of imprisonment in Japan, and several were prisoners of war in Germany for shorter periods.

War and the Aleuts

When the island of Attu, far west in the Aleutians, was recaptured by American forces, no trace was found of its 45 native inhabitants or Mr. and Mrs. C. Foster Jones, Indian Service employees. Mrs. Jones taught the children in the village school, and her husband acted as special assistant. He also operated the Weather Bureau station on the island, sending daily reports by radio. It was not until August 1945 that any news of them was received. The Japanese had occupied the island on June 7, 1942.

In July 1945 a representative of the International Red Cross found Mrs. Jones in Totsuka, a small village near Yokohama, where she was held as a civilian prisoner of war, in company with 18 Australian nurses. After the surrender of Japan she was promptly released and flown back to the United States. She arrived in Chicago on September 30, her sixty-sixth birthday.

According to her account, it was not until the Japanese started firing upon the village from the hills that the inhabitants of Attu realized that the invasion had come. One woman was slightly wounded. On the following morning, Mrs. Jones said, her husband was taken away by the guards, and the following day she was told by Aleut friends that he was dead and that they had buried him in the churchyard. Not long afterward she was taken to Japan.

On her return to Washington Mrs. Jones received from the Secretary of the Interior a check for \$6,887.54, covering her salary for the time spent in captivity. During her absence she and her husband received awards of excellence from the Department's Suggestions Committee, along with salary promotions and a war bond. Mrs. Jones retired soon after her return.

In September 1945 a group of the Aleuts from Attu were discovered in Hokkaido. They had been taken to Japan some months after the occupation of Attu and had spent 3 years working in the clay pits. The heavy labor, lack of food and medicine, and the dust of the pits combined to bring about the death of more than half of them. When they were discovered only 23 of the original 45 remained alive. Thirteen died of tuberculosis. Several children born during their stay in Japan failed to survive.

After the return to the United States two of the older people were hospitalized for tuberculosis at the Tacoma Indian Hospital. The Aleuts

landed in San Francisco in November 1945 and were met by Indian Service social workers and representatives of the Red Cross. After a brief stay in Seattle, they went on to Alaska. Because the group was now too small to maintain a community on Attu, they decided to make their homes on Atka, where many had friends and relatives. Sixteen persons finally reached their destination on Atka. Five children stayed at the Eklutna Vocational School, Alaska.

War Relocation Authority

DILLON S. MYER, *Director*



DURING the fiscal year 1946 all efforts of the War Relocation Authority were pointed toward the goal of orderly and final liquidation of the program. In this 1 year 60,000 persons, more than in all the 3 preceding years, went out of the centers to establish themselves in new homes. During the fall of 1945, 8 of the remaining 9 relocation centers were completely depopulated of evacuee residents. In March 1946 Tule Lake Center closed. In February, the Emergency Refugee Shelter, which had housed 982 refugees from Europe since August of 1944, closed after the great majority of the refugees had been permitted to enter the United States as quota immigrants. By May 15 the last of the relocation offices which had been established to help evacuees with their resettlement problems were discontinued and the few remaining problems were turned over to local resettlement committees. On June 30, the Authority, by Executive Order No. 9742, came to its official end.

Resettlement

Many acts of terrorism were perpetrated during the spring of 1945 toward the evacuees who were returning to the west coast. After the press of the Nation became cognizant of these racist activities and launched vigorous editorials condemning them, and after the people had become aware of the record of the Nisei soldiers, such incidents became increasingly infrequent. The last recorded incident occurred on January 29, 1946. Some of the persons responsible for these terroristic acts were brought to trial and punished. A series of public addresses throughout the West Coast States in the fall by five Caucasian Army officers who had fought with Nisei in both the European and Pacific theaters helped immeasurably toward an understanding of the Japanese-American group. The speaking tours were arranged through the Army Speakers Bureau and the officers went to west coast communities where opposition had been particularly vehement.

The growing appreciation of the Nisei soldiers which arose from this speaking program and from the continued publicity about the service of the Japanese American servicemen, reached a fitting culmination when Gen. Joseph W. Stilwell, Commander of the United States Tenth Army,

flew across the country to Talbert, Calif., and on December 8 presented Mary Masuda with the Distinguished Service Cross posthumously awarded to her brother, Staff Sgt. Kazuo Masuda. This dramatic event received Nation-wide notice. A few months later, the first Congressional Medal of Honor awarded to a Nisei soldier was presented to the parents of Private First Class Sadao S. Munemori.

Although acts of terrorism markedly decreased, there still existed various types of discrimination against the evacuees who returned to the west coast. These were in the form of restrictive covenants, escheat proceedings, restrictions on business and fishing licenses, and various types of economic boycotts.

Several major steps were taken, on the other hand, which erased much of the discrimination against Japanese Americans on a national scale. During most of the war period Nisei had been required to undergo an investigation prior to taking any civil service position, the delay involved often jeopardizing the appointment. On September 14 this requirement was lifted. Citizens of Japanese ancestry, although serving creditably in the Army, had been barred from the Navy and the Marine Corps. These bars were also lifted in November and Nisei have been accepted in these services. Many Federal restrictions against Japanese alien residents have also been removed, such as the necessity of reporting changes of address and employment, carrying registration cards, and having their bank accounts and other assets blocked. Contraband articles have been returned to their owners. These changes in the status of the evacuated people mark a noteworthy advance since the end of the last fiscal year.

This betterment of the position of the 109,300 people who had departed from the isolated and institutionalized life of the relocation centers improved the opportunities for adjustment in the communities in which they resettled. These communities are in 47 States, Hawaii, and Alaska. Of the total, approximately 57,000 returned to the 3 West Coast States, 52,000 relocated in the rest of the continental United States, 1,108 went to Hawaii, and 82 to Alaska. Many of the 25,788 young men of Japanese ancestry who were inducted into the armed forces have by now been discharged and have joined their families. About 13,000 of these boys were from the mainland—2,355 having been inducted directly from the relocation centers—and the remainder from Hawaii.

The one State in which no evacuees have resettled with assistance from the Authority is South Carolina. Illinois has the heaviest concentration with 11,200. Colorado and Utah are next with about 5,000 each, and Ohio, Idaho, Michigan, New York, New Jersey, and Minnesota have numbers ranging from nearly 4,000 to 1,700. Some 5,600 people who had been settled in other parts of the United States returned to the west coast with the assistance of the Authority after the lifting of the exclusion orders. Many of these were young people who had left the centers early and then felt it necessary to join their parents in returning to old homes.

The finding of a home was a problem for the evacuees, as for many people in the United States. It was a particularly crucial one in the war-congested metropolitan areas of California. Evacuees still owning homes there often experienced difficulty in repossessing the premises and terminating leases. For others there was no housing immediately available. Some moved in with friends and relatives, and many went to the more than 100 hostels which were operated by individuals and church groups with furniture borrowed from the Authority. Beginning in August, the Federal Public Housing Authority was able to take some of the evacuees into its regular projects either as members of veterans' families or as persons displaced by the war. Even these measures were not sufficient, however, and the Authority arranged to take over a number of surplus Army barracks and installations which could be remodeled to provide temporarily for the incoming evacuees while they were looking for employment and housing. Ten such projects in the Los Angeles and San Francisco areas were remodeled and supervised by the Federal Public Housing Authority by agreements with the War Relocation Authority.

The greatest problem during the winter and spring of 1946 was to assist people in moving from the temporary installations into permanent homes. The relocation offices, with local groups and agencies cooperating, made an intensive effort and by May 15 all the installations were closed. The people not yet permanently placed went to a project set up in the city of Santa Monica, to an installation in San Francisco remodeled for family living, to a trailer camp in Burbank, and to privately run hostels which had become regular rooming houses. The San Francisco and Burbank installations were prepared with Authority funds and run as regular Federal Public Housing Authority projects. Welfare cases were taken care of by the counties.

The Authority had faced a considerable problem in seeing that proper provision was made for all welfare cases. Throughout the country persons in need were able to secure assistance until June 30 through the program of "aid to enemy aliens and others affected by restrictive governmental action" which was administered through the Social Security Board. However, the Authority had encouraged evacuees in need to return to their counties of residence. Before the evacuation there had been practically no Japanese on relief. As a result of evacuation many were in need of public assistance. All counties in California accepted the responsibility. Los Angeles County had the heaviest load and made several requests for Federal help. The County has, however, assumed the burden and is doing an adequate job. The Authority feels that the continuing needs of these people will be adequately met.

Evacuees have had comparatively little trouble in finding employment. As has been the case since the people began leaving the centers, all who desire to work have been able to obtain jobs. In many areas these jobs are better than those which Japanese Americans were able to find before

evacuation. On the west coast, although there is a plenitude of work on farms, as laborers or as domestics, white-collar workers have had a more difficult time. Nisei have been reinstated in most cases in the California State Civil Service system. As a whole, however, the younger Japanese Americans are able to take good advantage of the high educational standards which they have attained.

While the people were pouring out of the centers during the fall of 1945, and up to the time when the area relocation offices closed, these offices were extremely busy with the adjustment problems of the resettlers. But the effort had also been made to help in the organizing of local resettlement committees to provide assistance in such fields as housing, education, welfare, employment, legal aid and general community orientation. There are at least 87 such committees and 222 community agencies which have committed themselves to provide services for the resettlers. In the East and Middle West these committees took form during the fall of 1945, on the west coast during the winter and spring. The active interest which has been generated gives promise that the general welfare and progressive orientation of evacuees settled in their communities will not be neglected.

During the fall of 1945 the main transportation of evacuee property was from the centers to new relocation addresses. After that property was moved out of the Government warehouses on the west coast to the owners. By May 1 all the property under Government supervision was disposed of, with only a residue of less than one percent not having been claimed. Evacuees had suffered considerable loss of property through vandalism, mishandling, damage, and malfeasance. The War Relocation Authority, which handled many inquiries about these losses, recommended that evacuation claims legislation should be enacted by the Congress which would provide the opportunity for the filing and adjudication of claims for losses resulting from the evacuation, of real or personal property or the impairment of assets.

Closing the Centers

On July 13, 1945, a definite schedule for the closing of the relocation centers was announced by the Authority. All centers (except Tule Lake) were set to close at 2-week intervals, the first on October 15, the last on December 15. The population of all the centers on July 1 was 62,703, of which 17,454 were at Tule Lake.

In July there was still a feeling among the center residents that there would be a residue of "unrelocatable" people when the centers closed. On August 1, however, these feelings were effectively dissipated by the announcement that project directors should schedule departures during the last 6 weeks before the closing date. This scheduling was intended primarily to provide for an orderly flow of departures so that facilities would not be overloaded and provisions might be made for housing. On September 4 the last bar to evacuees returning to the west coast was lifted when the Western Defense Command issued a proclamation rescinding all in-

dividual exclusion orders and other restrictions. By the end of August, over 2,000 persons were leaving the centers each week. During the week ending September 22, over 3,800 left. As the people departed, messhalls and blocks closed, and more and more services were discontinued. All the people were given individual assistance in formulating their plans, monetary assistance for transportation and resettlement grants where needed. None of them left without assurance that at least temporary housing would be available, and welfare help if necessary.

Every center closed on or slightly ahead of schedule. The following are the actual closing dates: Granada, October 15; Minidoka, October 28; Central Utah, October 31; Gila River and Heart Mountain, October 10; Manzanar, November 21; Colorado River, November 28; and Rohwer, November 30. Jerome had already closed on June 30, 1944.

After the centers were vacated, the appointed staffs turned to the job of putting them in stand-by condition to turn over to disposal agencies, preparing final reports, and shipping the center records to Washington for final disposition.

The War Relocation Authority had under its jurisdiction \$100,000,000 worth of Government property. By May 26, 1946, all but a very small portion of this had been disposed of. The \$35,000,000 of movable assets had been declared surplus and disposed of mainly to the War Assets Administration. The \$65,000,000 in fixed assets had been declared to the War Assets Administration which in turn declared them to the departments interested. Two of the centers went to the Farm Credit Administration, Agriculture Department, seven to the General Land Office, Department of the Interior. Minidoka, Heart Mountain, and Tule Lake eventually came under the custody of the Bureau of Reclamation; Colorado River under the Office of Indian Affairs. Jerome had already been turned over to the War Department.

The Authority had always made efforts to document its program as extensively as possible. It was felt that the program was unique and that complete records of all activities would be of value to administrators and students in the future. Reports from everyone who has been in charge of an activity or a program, together with other file and documentary material are deposited in the National Archives. In addition duplicate sets of much of the material is available at the Libraries of the University of California at Berkeley and Los Angeles. The records of the Emergency Refugee Shelter have similarly been prepared and sent to the library at Columbia University. In addition to the archival records, several monographs and special reports have been prepared for public dissemination.

Tule Lake

After the lifting of the mass exclusion orders on January 2, 1945, relocation offices had been set up at Tule Lake and a trickle of people had left for outside communities. Pro-Japan activities and pressures had

lessened considerably after the leaders of the "Hoshidan" were sent to internment camps. With the end of the war against Japan on August 15 and the rescinding of the Army's detainee and excludee restrictions on September 4, the people of the center began to take a more realistic approach to the problems of their future. Although bizarre rumors were still circulated by a minority of Tule Lake residents even after V-J Day, the majority of the people definitely wanted to settle in America. On October 18 it was announced that February 1, 1946, would be the closing date for Tule Lake and that all eligibles would have to relocate by then, the Department of Justice accepting responsibility for all restricted persons. Between July 1 and February 1, nearly 12,600 persons left the center. Of these approximately 8,500 resettled, about 4,000 sailed for Japan, and about 100 went to Department of Justice internment camps. Return to Japan was purely voluntary.

While residents were leaving Tule Lake in such numbers, renunciants and others detained by the Department of Justice were still uncertain as to their fate. It became evident that the majority had no desire to go to Japan, that their renunciations had been made in moods of bitterness and under extreme pressure. When asked to sign Department of Justice repatriation requests, they registered their protest. The President, the Attorney General, the Secretary of the Interior, and the Director of the War Relocation Authority received a large volume of letters pleading that they not be deported. More than 1,000 joined a mass habeas corpus suit which is still to be heard before the Federal District Court of Northern California. Until December 10 it was thought that the renunciants might all be deported on a categorical basis. However, on that day, following an urgent recommendation from the Secretary of the Interior to the Attorney General, the Department of Justice announced that the renunciants would have an opportunity to ask for and have a hearing before special officers of the Department to show cause why they should not be deported. The Authority agreed to keep Tule Lake open while the hearings took place and to help cleared persons to relocate. Between January 7 and February 6, 3,186 renunciant hearings were held. Of these, 2,780 were given releases to relocate anywhere in the United States—although they did not regain their citizenship, and 406, with 41 family members, went to an internment camp. Sixty of the releases arrived within the last 24 hours before the final train pulled out for Crystal City on March 20. Tule Lake the last center, was then closed.

Legal Developments

During this year a number of discriminatory rulings were being contested by Japanese Americans. One of these was a mandamus action brought against the State Board of Equalization in California for its failure to grant business licenses. The ruling of the Board was subsequently reversed. The city commissioners of Portland, Oreg., have similarly re-

fused to grant business licenses to alien Japanese, but the matter has not been satisfactorily settled as yet. On June 13 the judge of the Superior Court in Los Angeles ruled that the law barring aliens ineligible to citizenship from obtaining commercial fishing licenses was unconstitutional. The escheat case of *Fred Oyama v. the State of California* was heard before the Supreme Court of California on June 13 but not decided prior to June 30. The decision in this case, which is based on the constitutionality of the alien land laws, will affect the more than 50 escheat cases which have been brought in California.

A bill that would permit the Attorney General some discretion to allow potentially deportable Japanese aliens to remain in the United States in cases of hardship has been introduced in the House of Representatives. This bill would affect the many families where one of the parents, having entered the United States as a treaty merchant, is now subject to deportation because of the abrogation of the treaty with Japan in 1941. The Immigration and Naturalization Service granted a stay of deportation for these hardship cases early in June, pending a settlement of the legal issues.

Further legislation was also pending with the introduction in the Senate of a bill (S. 2127) which would establish an Evacuation Claims Commission. The bill provides for a Commission under the Secretary of the Interior to consider claims for loss of personal or real property or impairment of assets arising out of the evacuation. The Secretary of the Interior and the national Director of the War Relocation Authority have advocated the adoption of this legislation which has also been urged by many individuals and national organizations.

The Refugee Shelter

During the first 6 months of the fiscal year, the hopes of the refugees at the Emergency Refugee Shelter alternately rose and fell. The desire of the great majority was to be allowed to remain in the United States and not to return to war-torn Europe where homes had been destroyed and families had disappeared. On July 6 the conclusions reached by the House Committee on Immigration and Naturalization after hearings conducted at the shelter were announced. The report recommended that the Departments of State and Justice should make an investigation to determine whether it was practicable to return the refugees immediately to their homelands. If not practicable, the committee recommended that they should be declared illegal entrants by the Attorney General and deportation proceedings undertaken.

Accordingly, between September 12 and 24, a panel composed of representatives of the State and Justice Departments—and the War Relocation Authority by invitation of the other two—undertook to interrogate all the 912 refugees still remaining at the shelter. They were placed in three categories: 32 wished to return to their homelands, 72 desired to seek admission to other countries, and 814 gave reasons for not returning

to Europe. The Authority felt that, in view of conditions in Europe and the policy of UNRRA not to force involuntary repatriation, the majority of the refugees should be permitted to remain in the United States. Considerable negotiation over these points took place between the Departments concerned.

The concern of the refugees was ended on December 22 when the President announced that they would be permitted to apply for admission to the United States under the immigration laws.

Between January 7 and 14 the residents were processed by representatives of the Immigration and Naturalization Service, the State Department, and the United States Public Health Service. The first group departed to proceed by bus to Niagara Falls and there enter the United States through the consulate. Representatives of the National Refugee Service and other cooperating private agencies helped the people with their resettlement plans and assumed responsibility for them after they left the shelter gate. Of the 899 aliens at the shelter, 853 were granted entrance to the United States under the quotas of their respective countries and 46 were given temporary permits—19 because they were adjudged inadmissible, 19 while they awaited repatriation, and 8 while they awaited emigration to a country of their choice.

The refugees resettled in 70 communities in 19 States and the District of Columbia, the greatest number centering in New York City. There seemed to be good promise of their quick assimilation, a process aided by their having learned English and experienced something of the life of an American community while they stayed in the shelter.

With the closing of the last field office on May 15, the War Relocation Authority feels that the job which can be done by a Federal agency devoted solely to the interests of this group of people has been accomplished. The people have been returned to normal American communities and started on the road of readjustment and security. The continuing problems of adjusting the American community to the Japanese-Americans and the Japanese-Americans to the community is one which properly falls on the shoulders of private groups and local agencies. Further help by the Federal Government should be given these people on the same basis as it is given to any other residents of the United States. However, there are three main recommendations which the Authority feels should be made, the accomplishment of which would materially aid the future of that segment of the national population called Japanese-American:

- (1) Local resettlement committees should be encouraged to work with the evacuees as long as there remains any problem.

- (2) The Evacuation Claims Commission bill should be passed so that evacuees may be reimbursed for the losses which they suffered through no fault of their own.

- (3) Aliens, such as the Japanese, who have been resident in this country for many years, should be permitted to become naturalized citizens.

Office of the Solicitor

FELIX S. COHEN, *Acting Solicitor*



DURING the war many of the important functions and programs of the Department were of necessity curtailed or held in abeyance. The fiscal year just ended has seen the resumption, and in notable instances the fruition, of a number of these programs.

The Solicitor's Office was called upon during the past year for legal counsel and guidance with respect to novel and complex questions of law and administration affecting an untold variety of activities scattered over half the globe, from the Pribilof Islands of the Bering Sea to the Virgin Islands 1,500 miles off the coast of Florida, and which are to be found in virtually every section of the continental United States and its possessions; activities which range from the settlement of old Indian treaty claims to the control of atomic energy.

The war brought many new responsibilities to the Department, and, as a natural incident thereto, a corresponding increase in the volume, novelty, and complexity of the legal problems which devolved upon the Office of the Solicitor.

During the year and just subsequent to its close, the position of Solicitor had three incumbents. Fowler Harper resigned on September 10, 1945, and after an interim period in which Felix S. Cohen served as Acting Solicitor, Warner W. Gardner, whose tenure as Solicitor had been interrupted by war service, resumed the position after his discharge as a major in the Army Intelligence Service on October 12, 1945. The resignation of Harold L. Ickes as Secretary on February 15, 1946, necessitated several administrative readjustments pending the appointment of a new Secretary. Mr. Gardner served as Acting Assistant Secretary until June 17, 1946, when he took office as Assistant Secretary, following Senate confirmation. Mr. Cohen served generally as Acting Solicitor from February until the end of the fiscal year.

The ensuing summaries are indicative, briefly, of the legal work coming within the purview of the Office of the Solicitor.

Legislation.—Much of the new legal work of the Department has arisen in connection with legislation recently introduced or enacted, affecting existing functions or authorizing new ones. The Solicitor, through the Legislative Division of his office, is primarily and ultimately responsible

for the orderly presentation of the essential facts, as they affect the Department, to the several committees of the Congress, and for careful attention to the many phases incident to the legislative processes. These include, among other things, the preparation of reports to congressional committees and to the Bureau of the Budget with respect to all bills affecting the Department; the attendance and representation of the Department at congressional hearings; the drafting of suggested amendments to bills; the reporting on enrolled bills, including the preparation of suggested veto messages or memoranda of disapproval; and, in a number of instances, the preparation of material forming the basis of statements or testimony to be made by the Secretary or his representatives before congressional committees. The total number of items handled by the Legislative Division increased from 2,698 in 1945 to 4,495 for the fiscal year ended June 30, 1946.

Much of the spade work in connection with legislation is done in the Bureaus which may be especially affected by particular bills. The Solicitor's Office, however, must coordinate these special interests in harmony with the over-all policies of the Department and the purposes of the bill under consideration.

Among the many laws of particular interest to the Department enacted by the Seventy-ninth Congress, a measure of special importance was Public Law 726, establishing an Indian Claims Commission. The Commission is authorized to entertain and adjudicate all hitherto unsettled Indian claims arising from treaty, aboriginal, or other rights which may be asserted by Indian nations or tribes. It provides that all existing claims shall be filed within 5 years from the date of the act or be forever barred, and that claims arising after passage of the act shall fall within the regular jurisdiction of the Court of Claims. Most of the work in connection with the enactment of this law devolved upon the Associate Solicitor and the Legislative Division, in cooperation with the Office of Indian Affairs. Countless hours were spent in the preparation of material and statistics for the information of the Indian Affairs Committees of the Congress, in the redrafting of controversial sections of the bill for committee consideration, in attendance at frequent conferences and committee hearings, in the preparation of reports to the President, through the Bureau of the Budget, indicating the Department's reasons for urging approval by the President, and in disposing of many other highly technical legal questions which arose in the deliberations of the committees or were presented by representatives of the Indians or of other interested agencies. The bill as enacted would seem to be the nearest approximation to a final and just solution of this old and vexatious problem that reasonably could be hoped for.

Another act of first importance to the Department is the Strategic and Critical Materials Stock Piling Act of 1946 (Public Law 520). This act provides for the stock piling by the United States of certain strategic and

critical materials required for national defense, for the regulation of quantities and qualities to be stock piled, and for the release of stock-pile material in a manner so as not to affect adversely industry or the general welfare and economy of the Nation. The Secretary's representative served on a special interdepartmental committee instituted by the Director of the Office of War Mobilization and Reconversion to draft a bill which would be satisfactory to the President. The Chief of the Legislative Division and a member of his staff participated in numerous conferences with representatives of the Army and Navy Munitions Board, representing the armed services, the Bureau of the Budget, the Office of War Mobilization and Reconversion, and the Treasury Department in the preparation of the preliminary and final drafts of the bill as eventually introduced.

The Mineral Leasing Act of 1920 was amended in several important respects (Public Law 696); for example, a flat 12½ percent royalty on wild-cat leases was prescribed and the limitations upon acreage holdings and options were liberalized. The legal work in connection with the consideration of these amendments involved the preparation of reports, attendance at numerous congressional hearings, and participation in conferences with members of Congress, and required months of time and attention on the part of several lawyers in the immediate Office of the Solicitor. Considerable work was also done by the lawyers of the General Land Office and of the Geological Survey.

The approach of July 4, 1946, the date set by the Philippine Independence Act of 1934 for the withdrawal of United States sovereignty over the Philippines, brought a number of intricate legal problems from the Office of the United States High Commissioner. Some of them, although foreseen as inevitably accompanying so unusual a transaction in international affairs, were complicated by the war and by the very recent cessation of the military activities designed to utilize the Philippines as the staging area for the invasion of Japan. Other problems were created by the war itself and by the vast destruction that it wrought throughout the islands. The Solicitor was called upon for opinions, among others, concerning the authority of the Commonwealth legislature to continue to function *de facto*, notwithstanding the expiration of the terms of some members; on the validity of the payment of prewar debts by Japanese fiat money during the period of enemy occupation; and determining the effect of the withdrawal of United States sovereignty on the title to property in the islands held by the Federal Government. Changes in conditions brought about by the war necessitated legislation to mitigate hardships that would otherwise seriously handicap the independent Republic of the Philippines at its birth. The Solicitor's Office assisted and advised the High Commissioner in connection with legislation authorizing a special election for a President and Vice President of the Commonwealth (Public Law 258); to compensate for war damage and otherwise assist in the rehabilitation of the Philip-

pinos (Public Law 370); to define trade relations between the Republic of the Philippines and the United States (Public Law 371); to authorize the naturalization of Filipinos as United States citizens (Public Law 483); and to permit the United States to continue to hold title to most of its property in the islands during the 4-year period of rehabilitation (Public Law 485). The Solicitor's Office participated, finally, in the preparation of the Proclamation of Philippine Independence, issued by the President of the United States on July 4, 1946.

Public Lands.—Defense of the interests of the United States in litigation occupied much of the time of the Public Lands Division of the Solicitor's Office. Three cases involving railroad grant lands were handled before the Court of Appeals, and the Division assisted the Department of Justice in obtaining a writ of certiorari from the United States Supreme Court to review adverse decisions in two of the cases. The antitrust suits brought against the borax combine were satisfactorily settled by the entering of a consent decree providing for the dismissal by the United States Borax Co. of its suit against the Secretary to obtain patent to a tract believed to contain millions of dollars worth of sodium borate. The Department of Justice was assisted in the suit brought by the United States to determine ownership of the submerged coastal lands in California and also in the preparation of legislative reports and statements relative to proposed tidelands oil legislation. Substantial legal service was also rendered by the Public Lands Division and the Legal Division of the Geological Survey in two cases involving the authority of the Secretary to fix minimum valuations on oil and gas for the purpose of computing Government royalties and title of the United States to a section of rich oil land in the Elk Basin field. The Solicitor's Office also participated in litigation involving the control by the Secretary of submerged lands of critical importance in the Alaska fisheries.

The complex ramifications of conflicting claims to a tract of oil land in Kern County, Calif., were unraveled in a solicitor's opinion which recommended the institution of a suit to confirm the Government's ownership and to compensate the Government for past extraction of oil. Basic revisions were suggested in national park concession contracts. Plans looking toward the reorganization of functions in the Department, and delegations of authority from the Secretary to various Bureau heads, were prepared or reviewed. The Office of the Chief Counsel of the General Land Office undertook the legal work in connection with the activities of the newly established Surplus Property Division of the General Land Office, including the preparation of regulations implementing the procedure governing the disposal of surplus real property; and it played an active role in the preparations incident to the merging of the General Land Office and the Grazing Service into the Bureau of Land Management and the transfer to the Department of the Interior of the function of disposing of mineral deposits in certain of the acquired lands held by the Depart-

ment of Agriculture. An attorney was placed in the field with the O. and C. Administration at Portland, Oreg., to assist that office in the wide variety of legal matters with which it is constantly confronted, including the problems arising in connection with the initiation of hearings in connection with the establishment of sustained yield units on O. and C. lands.

During the fiscal year the Public Lands Division reviewed more than 27,000 items and prepared more than 730 items.

A substantial amount of legal work was performed by the Office of the Chief Counsel of the Geological Survey in the consummation of 24 new unit agreements, most of which were designed to promote the search for and the development of new oil and gas reserves in wildcat areas. Sixty-nine unit agreements were terminated during the year. This left 131 approved plans covering 1,722,022 acres of public domain lands outstanding as of June 30, 1946. Thirty legal opinions were rendered on subjects affecting the Geological Survey during the year; 38 accident cases involving Geological Survey motor vehicles were adjudicated; and 8 applications for patent based upon inventions made by Survey employees were initiated and processed pursuant to Departmental Orders Nos. 1763 and 1871 for submission to the Department of Justice.

The Chief Counsel's Office of the Grazing Service disposed of many matters, including the preparation of rules and regulations and orders affecting the administration of the Federal range; the preparation of contracts and cooperative agreements with individuals, livestock associations, State cooperative grazing districts, and Federal and State agencies; the codifying of rules and regulations of the Grazing Service for publication in the Code of Federal Regulations; assisting in the preparation of departmental and Executive orders of withdrawals or modifications of withdrawals affecting grazing districts; commenting on and transmitting appeals from examiners' decisions on grazing applications; and reviewing cases involving contributions under Section 9 of the Taylor Grazing Act for range improvement and other beneficial purposes. Under the Reorganization Act of 1946, the Grazing Service has been transferred to the Bureau of Land Management.

Property Acquisition.—The Property Acquisition Division of the Solicitor's Office participated in the preparation of contracts for the purchase of properties and has performed the necessary legal work to effect the acquisitions required for the helium program, synthetic liquid fuels program, mineral exploration projects, and oil shale plants and laboratories. The validity of the titles to more than 128,012 acres of land acquired by the Government under the Forest Exchange Act and the Taylor Grazing Act was also passed upon, and the consolidation of Indian land holdings, the acquisition of homes for Indians, and the acquisition and exchange of lands for Indian tribes involved considerable legal work. Thousands of acres of donated land were accepted by the Government for national parks upon approval of the titles by the Property Acquisition Division.

Mineral development.—Many, if not all, of the known deposits of strategic and critical minerals were seriously depleted by the war. The necessity of restoring supplies to a level adequate to meet the requirements of national defense and industry is a problem of first importance and the special responsibility of this Department.

The development of atomic energy immediately posed the question of how to control fissionable material. The Department succeeded in its efforts to have the Congress include in the bill for the control of atomic energy (Public Law 585) certain provisions to accomplish this end. In addition to the work done on stock-pile and mineral-leasing legislation, many hours were consumed in writing reports, preparing statistics, and attending hearings with respect to several bills for scientific research and development, all of which vitally affected several agencies of the Department. No bill, for this purpose, has as yet passed the Congress but similar legislation will doubtless be introduced in the next Congress.

During the year 117 invention reports, including 16 originating in the synthetic liquid fuels program, were processed by the patent attorneys of the Mines Division of the Office of the Solicitor. Including the cases mentioned above, action by the Division was taken in 232 patent cases. There are pending in the Patent Office 107 patent applications, of which 71 have been assigned to the Government. The synthetic liquid fuels program has required the processing of numerous contracts for construction of facilities and purchase of equipment, the most important of these contracts being one for the construction of a coal hydrogenation demonstration plant at Louisiana, Mo., at an estimated cost of more than 6 million dollars. Assistance has been given the Bureau of Mines in securing construction authorizations and preference ratings and in meeting other problems arising under Civilian Production Administration controls. The Division has processed approximately 300 contract matters during the year, including those relating to synthetic liquid fuels. Other contracts include the purchase of supplies, the sale of helium, cooperative agreements, and exploratory drilling. It also has reviewed, revised, and codified numerous regulations relating to Bureau of Mines activities, has prepared or reviewed proposed municipal, State, and Federal Safety legislation, and has prepared reports upon legislative matters affecting the Bureau of Mines.

The Department has also pioneered in the drafting of legislation to develop a national fertilizer policy and program, utilizing existing plants in the West and the T. V. A. plant at Mobile, Ala. The plans call for the comprehensive development of processes and methods, consistently with sound conservation policies, for the economic use of our vast potash and potassium reserves on the public domain; the establishment of farm demonstration programs; the prevention of monopolistic control of this industry of such vital importance to our agricultural communities; and the eventual operation by farm cooperatives of the Government-sponsored plants.

Territories.—With the termination of the war, renewed consideration was given to the question of statehood for Hawaii and Alaska and a change in the political status of Puerto Rico, and assistance was rendered to congressional committees in the consideration of legislation looking to these ends. The Solicitor's Office was called upon to render legal assistance to the Government of Puerto Rico in a series of cases challenging the constitutionality of the insular agricultural development, transportation, communication, and land acquisition programs. Except for the communications case, which had not gone to trial at the close of the fiscal year and in which a preliminary injunction was still outstanding, the constitutionality of the Puerto Rican social legislation was upheld, in each of these critical cases, notwithstanding initial adverse decisions.

In addition to the preparation of many bills and reports affecting the territories and insular possessions, the legislative activities of the Division included the consideration of four bills, passed over the votes of the Governors of those islands by the local legislatures. Acting on recommendations of the Secretary, the President upheld the veto by the Governor of Puerto Rico of a bill providing for an insular poll to determine the Puerto Ricans' choice for Governor and permitted a wage and hour law amendment of the municipal council of St. Thomas and St. John, Virgin Islands, to become law without his signature.

After a series of meetings with Department, Territorial and industry officials, bills were drafted for the Governor of Alaska to be introduced by him in the Territorial legislature at the coming session, to regulate trap fishing and also to tax the incomes of businesses and corporation.

Other activities included the controversy over ownership of the mark and name Government House Rum which continues between the Virgin Islands Company and the former distributor; protest before the Maritime Commission against proposals by steamship companies to revise upward their freight and passenger rates; proceedings in behalf of the Territorial areas before the Civil Aeronautics Board for certificates to fly to and across those areas; the draft of regulations to govern the disposal of surplus property; and many other legal problems involved in the governing of our territorial and insular possessions.

Reclamation and power.—With the cessation of hostilities, the Bureau of Reclamation reverted to its role of a peacetime agency of the Department of the Interior. The Congress has authorized an enlarged program for the coming years to catch up with the accumulation of construction work which during the war years was held to a minimum. This backlog of construction work brought with it a vast number of legal problems. The answers to some of these problems have been found; others need further exploration and study.

To aid in the reorganization and decentralization of Bureau activities, the Secretary, pursuant to the provisions contained in the act of December 19, 1941 (55 Stat. 842), supplemented the existing delegations of authority

to the Commissioner of Reclamation. Some of these powers and duties were in turn redelegated to certain officers of the Bureau of Reclamation. Within certain limitations these redelegations contained authority and established procedures to be followed in connection with appraisals and acquisitions of land, interests in lands, and water rights, and related matters involved in the construction or operation and maintenance of projects under the act of June 17, 1902 (32 Stat. 388), and acts amendatory thereof or supplementary thereto. Early in January of this year, the Secretary amended Departmental Order No. 2018 so as to authorize the Commissioner to approve and execute any contract for construction, repair, supplies, services and equipment, or any change order thereto, where the amount does not exceed \$500,000. The necessary survey in regard to existing delegations of authority and the drafting of the delegations of authority from the Secretary to the Commissioner, together with the redelegations to various officers of the Bureau of Reclamation, has required one attorney to devote approximately all his time to this work.

Attention was given to matters pertaining to advertising, bids, awards, and execution of contracts for the purchase of supplies and equipment and for construction of project works. The number of construction and supply contracts executed during the fiscal year 1946 reflected the increased work load of the Bureau.

The contract for building the Kortes Dam and power plant on the North Platte River is of particular importance because it is first of many contracts that will be necessary in the construction of the work proposed in the Missouri River Basin.

Some of the more important matters relating to contracts receiving legal consideration were: A claim for increased compensation under the contract for construction of Shasta Dam; the termination of the contract for the Crooked River crossing on the Deschutes project, because of default in performance by the contractor; and the negotiation of a new contract for completion of this work.

Numerous administrative findings on contractor's appeals from contracting officer's findings of fact likewise were rendered by the Conservation Division of the Solicitor's Office. An outstanding example of the latter was the case of the Union Paving Co. of California, which involved 29 separate claims against the Department for additional compensation and the remission of liquidated damages.

A power contract which involved protracted negotiation and a large volume of work was the contract for the sale and delivery of Boulder electric energy to the Arizona Power Authority for resale in the State of Arizona.

Of outstanding importance to the Department was the opinion of September 10, 1945 (M. 33473 Supp.), prepared by the Conservation Division of the Solicitor's Office, defining the minimum revenue requirements with

respect to project repayment period, rate schedules, and interest bases for the Columbia Basin (Grand Coulee) project.

With the close of the fiscal year 1946, proposed legislation of far-reaching significance to Reclamation was pending before the Seventy-ninth Congress. Proposed legislation included House Bills 520, 5124, and 6574. House Bill 520 would "facilitate settlement of returning veterans on farms in projects constructed, operated, and maintained by the Bureau of Reclamation," Extensive hearings were held by the House Committee on Irrigation and Reclamation on House Bill 5124, a bill "Relating to the sale of electric power and power privileges under the Reclamation Project Act of 1939." One of the amendments would authorize the Secretary of the Interior, whenever opportunities arise in connection with Federal reclamation projects, to improve conditions for fish and wildlife and to provide recreational facilities on a nonreimbursable basis. The Solicitor of the Department, the Commissioner of Reclamation, the Director of the Fish and Wildlife Service, and the Associate Director of the National Park Service appeared before the Committee.

Laws in the enactment of which the immediate Office of the Solicitor as well as Bureau attorneys participated included, among others:

The act of July 14, 1945 (Public Law 143, 79th Cong., 1st sess.), to authorize the Secretary of the Interior to execute a contract between the United States and the Truckee-Carson irrigation district.

An amendment (act of March 6, 1946, 60 Stat. 36), to section 9 of the Boulder Canyon Project Act (45 Stat. 1057) which renewed and extended to veterans a preference in connection with the opening to homestead entry of public lands watered from the Gila Canal in Arizona and the All-American Canal in California.

The act of June 25, 1946 (Public Law 440, 79th Cong., 2d sess.), which amended the act of September 27, 1944 (58 Stat. 747), entitled "An act to allow credit in connection with certain homestead entries for military or naval service rendered during World War II." This amendment extended the benefits of the original act to persons under the age of 21 years who were otherwise qualified.

The War Department Civil Functions Appropriation Act, 1947, approved May 2, 1946. On May 3, the President issued a statement saying he was "glad to note that the Congress, by the addition of certain provisos to the item for the Kings River project, California, has afforded an opportunity for assuring that the Federal reclamation policy, including repayment and the wide distribution of benefits, will apply to that project."

The approval by the Congress of an interstate compact between the States of Colorado and New Mexico with respect to the waters of the Costilla Creek (act of June 11, 1946, Public Law 408, 79th Cong., 2d sess.).

The Flood Control Act of 1946 (Public Law 526) and the Rivers and Harbors Act of 1946 (Public Law 525), are also of outstanding importance not only to the Bureau but in the activities of the whole Department.

The Bureau of Reclamation's authority on the Colorado River was broadened by the act of June 28, 1946 (Public Law 469, 79th Cong., 2d sess.).

The Department participated with the Department of Justice in the handling of a number of important cases. Among these were the cases entitled, *United States v. Maclay, et al.*, and *United States v. Buckhouse*, two suits for the condemnation of property needed in connection with Big Flat Unit, Missoula Valley project, Montana; *Northern Pacific Railroad Company v. United States*, litigation continued throughout the year which required the drafting of the Government's brief, proposed findings, and a supporting statement of the facts. Counsel of the Bureau also participated in oral arguments in this case. A report was prepared recommending settlement of the long-pending Boise River flood water suit, *Pioneer Irrigation District v. American Ditch Association*. Bureau counsel also participated in the action, *Robins v. City of Rapid City, et al.*, an original proceeding under the Declaratory Judgments Act in the Supreme Court of South Dakota. This was a proceeding for a declaratory judgment involving questions of law alone and concerned the validity of a repayment contract entered into July 27, 1942, among the United States, the Rapid Valley water conservancy district, and Rapid City, S. Dak.

The Bureau's chief water rights attorney assisted representatives of the Department of Justice in the hearings conducted before a Commission of the Court of Claims in the action entitled, *Gerlach Live Stock Company v. United States*, and the seven related cases.

National Parks.—During the 1946 fiscal year the legal work in connection with the National Park Service involved more than 1,250 matters, including the preparation of legal opinions, correspondence and documents.

The work of the Chief Counsel's Office included the preparation and interpretation of regulations, the preparation and processing of legislation, the drafting and review of agreements, contracts and permits, and the handling of legal phases of land acquisition and water rights. Legal opinions were rendered on a variety of questions. Of interest were those concerning the Service's authority to control airplane landings on private lands in national parks subject to the exclusive jurisdiction of the United States; the power of the States of Wyoming, Montana, and Idaho, to tax Federal employees in Yellowstone National Park; the power of the State of California to require licenses for the sale of liquor on private lands within Yosemite National Park; and the jurisdiction of the United States and the various States with respect to the control of sanitation and health in National Park Service areas.

Fish and Wildlife.—An unprecedented volume of conservation legislation affecting the many varied programs and functions of the Fish and Wildlife Service required the almost constant consideration in the Solicitor's Office as well as by the Chief Counsel of that Service throughout the year. Involving far-reaching national as well as international participation by the Fish and Wildlife Service in the development and management of valuable fishery and other natural resources, these measures presented many novel drafting problems, required the preparation of numerous reports and other material for congressional committees, and attendance at frequent congressional hearings and departmental and interdepartmental discussions. Of particular interest because of its establishment of a clear national policy and program for the coordination of wildlife conservation problems was House Bill 6097 (Public Law 732). Again the authorization contained in the act for the rehabilitation of the Philippine Islands with respect to development and rehabilitation of the fishery resources of that country place further emphasis on the already important role that the United States is playing in the development and protection of international and national fishery resources. An international agreement covering the conservation of the fisheries of the Great Lakes finally was signed by Canada and the United States during April 1946. The intensified production of fish during the war years required careful consideration of revised regulations to offset marked decreases in these resources. Again for a second year somewhat drastic revision of the migratory waterfowl regulations was necessary to offset a market decrease in waterfowl populations. Numerous appeals to the Secretary from the decisions of the Area Coordinator of the Office of the Coordinator of Fisheries were disposed of through the Solicitor's Office.

Indian Affairs.—Noteworthy, among many other important and complex Indian cases was the Phelps Dodge Corporation's settlement with the San Carlos irrigation project. During the war the War Department had entered an order of taking permitting the Phelps Dodge Corporation to take such water from the San Carlos irrigation project as would permit the company to operate its mines at Morenci, Ariz., at full capacity. This taking gave rise to a claim against the United States and the company. Towards the close of 1945, the Phelps Dodge Corporation offered to pay \$275,000 in settlement of this claim, and the offer was accepted. The district and the Indians will share equally in the distribution of the fund.

In the field of legislation, the outstanding event was the enactment of the Indian Claims Commission Act (Public Law 726), Seventy-ninth Congress, August 13, 1946, bringing to a successful conclusion the effort of the Department over a long period of years to secure the establishment of an agency to investigate and settle the claims of Indian tribes against the United States which hitherto could be adjudicated only when a tribe secured a special jurisdictional act conferring jurisdiction on the Court

of Claims. Equally important, perhaps, was the passage of legislation to simplify the administration of Indian affairs by permitting the Secretary to delegate to the Commissioner of Indian Affairs his functions under laws governing Indian affairs, and further permitting the Commissioner to sub-delegate to his more responsible subordinates. The issuance of regulations may not, however, be delegated by the Secretary. A notable achievement in the field of irrigation was the enactment of legislation making adjustments of irrigation charges on the Crow Indian irrigation project, Montana (Public Law 468, 79th Cong., June 28, 1946).

Advisory opinions were rendered on two particularly difficult and complex questions, i. e., on the extent of the rights of the Colville and Spokane Indians in the Columbia River Reservoir under the act of June 29, 1940 (54 Stat. 703, M. 3426, December 29, 1945), and on the ownership of the minerals and other natural resources of the Hopi Executive Order Indian Reservation (M. 33821, June 11, 1946).

Counsel at Large, Alaska.—In addition to routine matters, the counsel at large participated in the settlement of disputes under contracts for drilling and exploring for the Bureau of Mines; the preparation of various matters in connection with conflicts over native possessions; hearings in Washington with respect to trap-site allocation and limitation; obtaining the return to the Alaska Railroad of property turned over to the military authorities, in procuring the transfer of certain Army property; the renewal of labor agreements; the lease and sale of floating equipment acquired from the Army; and many other unusual and varied activities.

Solid Fuels Administration for War.—To keep pace with the changing conditions resulting from victory in Europe, victory in Japan and transition from a wartime to a peacetime economy, the legal work incident to the Solid Fuels Administration for War involved the drafting of regulations, orders, exceptions and directions necessary to effectuate the Administration's policy to relax and eliminate its controls over the distribution of bituminous coal, anthracite and other solid fuel, as quickly as conditions warranted. The shortage of bituminous coal because of the strike in April and May and distribution difficulties occasioned by labor disputes and other causes in the several transportation fields, necessitated a departure from the Administration's plan to liquidate, and new regulations and directions had to be formulated and drafted. Opinions were rendered to the Administration in the matters of its regulatory functions and policy, and interpretations were prepared for issuance to the industry generally. The Legal Division of the Administration continued to supervise the organization and functioning of industry advisory groups and furnished such groups with legal advice with respect to their duties, as called upon. It handled all legal problems in connection with compliance proceedings brought to enforce regulations, and cooperated with the Department of Justice in the criminal prosecution of flagrant violations of the Admin-

istration's regulations. It also handled legal matters growing out of the Government's seizure of mines in 1944 and 1945, and cooperated with the Department of Justice in assembling evidence for the defense of litigation instituted against the Government for alleged damages occasioned by the Government's operation of coal mines during that period. With the breakdown of negotiations between the United Mine Workers and the bituminous coal operators in May of 1946, the Division drafted the initial orders and other documents incident to the 1946 Government seizure, and participated actively in the contract negotiations between the Secretary and the United Mine Workers, and otherwise cooperated with the Legal Division of the Coal Mines Administration.

War Relocation Authority.—After the closing of its 10 evacuee centers, the activities of the War Relocation Authority were terminated on June 30, 1946. During the preceding fiscal year the Solicitor's Office assisted in the program which succeeded in effecting the orderly return of center residents to normal communities. In the course of this relocation process numerous problems of Federal and State relations arose in connection with laws relating to welfare, unemployment and compensation insurance, and the enforcement of civil rights. Considerable legal assistance also was provided in the handling of surplus property and of disposal of land previously occupied by the several centers, and in aiding center residents in their arrangements to resume control of the homes, property, and enterprises they had left behind at the time of evacuation. Claims involving the rights of 93 evacuees of Japanese ancestry to damages for the loss of thousands of dollars in personal property resulting from a fire at a relocation center were decided in favor of the claimants in an opinion of the Solicitor (M. 34436) promulgated shortly after the close of the fiscal year. Eleven of the claims could not be certified to the Congress for payment since they were for amounts in excess of the statutory limitation (42 Stat. 1066, 31 U. S. C. sec. 215) of \$1,000. These doubtless will be up for consideration in the next Congress in the form of bills for private relief, since they are not cognizable under the Federal Tort Claims Act of 1946 (Public Law 601), having accrued prior to January 1, 1945.

Other functions.—Three important pieces of legislation, applicable generally to all Government agencies, and which required much time in study and analysis on the part of the Department's lawyers were the Administrative Procedure Act (Public Law 404), the Employment Act (Public Law 304), and the Legislative Reorganization Act (Public Law 601). Title IV of the latter act, The Federal Tort Claims Act, which in substance makes the Federal Government liable in certain tort actions as though it were a private individual, it is anticipated will result in a great volume of new legal work in this field because of the far flung and varied nature of the Department's activities throughout the continental United States and island possessions, and for the further reason that it opens up an entirely

new field of recovery against the United States—damages on account of personal injury caused by the negligence of United States employees. The full implications of the legislation are being studied by attorneys in the Legislative and Conservation Divisions of the Solicitor's immediate office.

The Conservation Division completed compilation of secretarial orders and the resulting manual contains a headnote reference to every numbered order issued by the Secretary, beginning with No. 1 on January 27, 1925, and ending with No. 2208 on June 5, 1946.

The Division answered many questions involving the interpretation of contract provisions, for the Department as a whole, and passed on all claims for damage to private property resulting from the acts of Federal employees, the volume of which continued to increase. Many questions on fiscal law were answered involving the interpretation or construction of appropriation laws directly affecting the Interior Department, and numerous problems varying in degree of complexity in the personnel field answered, formally, and informally, including questions affecting leave differentials; eligibility for employment of retired commissioned officers; involving separation; hours of labor for wage board employees; questions involving the retirement laws; use of Government automobiles; leave allowance, including lump-sum terminal leave act provisions; transportation and transfer allowances, Secretarial authority to employ aircraft for travel purposes, payment of travel expenses of a Presidential appointee transferred within the Department and transfer and removal of families and household goods at Government expense.

Division of Territories and Island Possessions

EDWIN G. ARNOLD, *Director*



IN FULFILLING its comprehensive responsibility for guiding the territorial areas of the United States toward eventual self-government, the Division faced new duties and problems, as well as intensified and expanded functions during this first fiscal year following the end of hostilities. From an international standpoint the work of the Division increased tremendously in importance. With the close of the war the attention of the world was focused through the United Nations on the administration of non-self-governing areas.

The peoples of the four territorial areas—Alaska, Hawaii, Puerto Rico, and the Virgin Islands—with the encouragement and assistance of the Division, accelerated their progress toward self-government despite hardships and deprivations which were the inevitable aftermath of war.

In his annual message to the Congress on January 14, 1946, the President said:

I urge * * * that the Congress promptly accede to the wishes of the people of Hawaii that the Territory be admitted to statehood in our Union, and that similar action be taken with respect to Alaska as soon as it is certain that this is the desire of the people of that great Territory.

Political advances.—The most significant political advance affecting Alaska during the year was the enunciation by the Department of a policy favoring statehood for the Territory. This announcement supplemented the action of the territorial legislature in providing for a referendum on statehood by the voters of Alaska. During the year, the House Committee on Territories made an extended trip to Alaska and arranged, in cooperation with the Division, an investigation of the general political, governmental and economic structure of the Territory. The committee submitted a report sympathetic to the aspirations and needs of Alaska, but reserved comment on statehood or other proposed changes in the structure of the territorial government pending the outcome of the forthcoming plebiscite on statehood.

On December 22, 1945, the Secretary of the Interior issued a statement favoring statehood for Hawaii. "Self-government," he said, "is the right

of all peoples, and statehood is the framework of self-government most appropriate to Hawaii's economic and social situation." A congressional subcommittee held hearings in Hawaii in January 1946, on the subject of statehood. The Division and the territorial government facilitated the work of the subcommittee by arranging an itinerary of hearings on the principal islands at which testimony on all aspects of Hawaiian life was presented, and at which witnesses gave arguments for and against statehood. The subcommittee unanimously found that Hawaii meets the requirements for statehood and recommended that legislation to that end be given immediate consideration.

Acting on the Division's plan and request during the past year to encourage progress toward statehood for Hawaii, the Congress made available funds providing for the establishment of a new Pacific Branch within the Division to assist Hawaii in Washington and to take care of matters relating to the Equatorial Islands now under the jurisdiction of the Department of the Interior.

Prior to this, in October of 1945, the President had recommended that since the existing form of government in Puerto Rico seemed unsatisfactory to a large number of its inhabitants, Congress should enact legislation to submit various alternatives to the Puerto Rican people, in order to ascertain what the people themselves desire most for their political future. The President asked the Congress to authorize for the island a plebiscite to indicate preference among the following forms of political status: (1) The right of the Puerto Ricans to elect their own Governor with a wider measure of local self-government, (2) statehood, (3) complete independence, and (4) a dominion form of government.

On May 17, 1946, the inauguration of William H. Hastie, dean of the Law School of Howard University, as Governor of the Virgin Islands, marked the appointment for the first time of a Negro as Governor for a territorial area predominantly Negro in population. At the same time the Secretary of the Interior announced his full support of the desire of the Virgin Islands people to be represented in Congress by a resident commissioner. The Division drafted a bill to be offered to the Congress that would provide for a resident commissioner in Congress, the Virgin Islands now being the only organized area under this Department's jurisdiction which has no representative in Congress.

Reinforcing these steps toward increased self-government for the Virgin Islands, an Organic Act reform committee drafted recommendations for improvement in the Organic Act of the islands. The Organic Act of the Virgin Islands, passed in 1936 and the most recent of the Organic Acts, has been demonstrated to be short of ideal in several respects. The Division urged the creation of the Organic Act reform committee to make recommendations for corrective Federal legislation, and the committee is now at work in the islands.

Economic improvement.—The promotion of maximum self-sufficiency for the territories, a major responsibility of the Division linked inextricably to progress toward autonomy, was complicated during the past year by economic problems made more acute by wartime rigors and the task of restoring peacetime balance to the territorial economies.

In this connection the aiding and encouraging of the development of territorial natural resources—the initiating of new industries, the increase in agricultural improvements, and the planning and direction of the areas' tourist activities—were Division responsibilities that received priority attention at the close of the war.

Role of transportation in Alaskan life.—Postwar development in Alaska has been greatly hindered by a series of shipping uncertainties, the first being a request by the operators of commercial vessels to increase the already extremely high shipping rates by approximately 100 percent. This request for higher rates has been followed by longshore and other maritime labor disputes, all delaying or stopping shipments of goods to the Territory.

The effects of extended shipping tie-ups are as detrimental to Alaska's economy as a general railroad tie-up would be to the economy of the United States. They have resulted in shortages of food, clothing, and housing, and in economic stagnation. Many mining and other commercial operations, curtailed during the war period, have been prevented from reopening. Altogether they have caused great economic loss, hardship and suffering, and have set far behind anticipated postwar development.

In spite of these difficulties the Territory of Alaska continued to attract increasing numbers of settlers—veterans wishing to establish new homes, industrialists cognizant of the potentialities of new enterprises, others seeking opportunities in mining, fishing, or agriculture. The Alaska housing shortage became correspondingly more severe, with the Territory sharing in the general widespread shortage of building materials and construction labor.

Since large-scale building projects, colonization activities and development plans generally would be dependent for their success in large measure on the availability of transportation adequate in volume, quality, and cost, the Division devoted considerable time and energy to securing improved air and surface facilities.

By the end of the fiscal year, a complete rehabilitation program for the Alaska Railroad was already under way. The program is designed to put the railroad property in first class operating condition by improving the roadbed, roadway structure, and shop facilities, and by the addition of up-to-date motive power and rolling stock. The railroad, never completed to standard during its construction period, was operating before the war largely with out-of-date locomotives and train equipment. The further demand of traffic during the war period left the railroad in such

shape that a rehabilitation program was imperative if adequate and safe service were to be maintained and abnormal maintenance expenses were to be avoided. Preliminary negotiations by the Division to secure all surplus property possible for the improvement of the railroad were completed by the end of the year.

The Alaska Highway, the Canadian portion of which was turned over to the Canadian Government on April 3, 1946, remained closed to unrestricted pleasure traffic because service and stop-over facilities for travelers were lacking. The Alaskan portion of the highway was opened to all traffic, without restrictions, before the end of the fiscal year. The Alaska Road Commission continued the maintenance of this section of the route throughout the year at the request of the Army; but plans were completed for future maintenance of the road as a civilian operation and as a part of the central Alaskan road system.

Together with improvement in these existing facilities, advancement of plans for the construction of important new roads during the fiscal year forecasts increased land settlement and intensified mining operations, especially in the Kenai Peninsula and the Forty Mile section of Alaska. To add to the generally improved transportation picture, new commercial transportation services, begun during the fiscal year, include bus lines on the Alaska Highway, making it possible to travel from the States by land on common carriers for the first time in history.

Alaska development projects.—During the year, the Division has been working toward the formulation of an over-all plan for the general advancement of all phases of Alaskan life, with sufficient flexibility to allow for the Territory's constant development. Industrialists and other businessmen in increasing numbers became interested in Alaska's potentialities.

Postwar economy of Hawaii.—As an active base for United States military operations during the entire war, the strain unavoidably placed on the economic life of Hawaii made the task of restoring the Island's economic balance one of unusual magnitude.

On the credit side of Hawaii's ledger, the end of the war saw the partial resumption of private shipping between the west coast and Hawaii; commercial air transportation facilities were also restored, and private hotels used by the military during the wartime period were returned to private operation. The Division promoted and participated in negotiations to increase air service to and from the Islands.

The severe labor shortage in Hawaii, more serious than ever after the end of the war, was partially relieved by the return of veterans, by the termination of some war projects and by the authorization of the importation of 6,000 laborers from the Philippines.

The produce of Hawaii's two main industries, sugar and pineapple, was redirected from military channels to commercial trade.

As Hawaii's housing situation constantly grew more acute, every effort was made to turn back to the Hawaiian people as much territorial and

private land as possible. In answer to the Insular Government's plea, the Division urged the Army and Navy to release land held by them for the construction of dwellings. In the absence of building materials, however, efforts were made to convert to civilian use untenanted barracks and dormitories of military installations.

Scarcity of housing facilities, of certain food items and of agricultural products temporarily discouraged Hawaii's tourist industry, but it is anticipated that Hawaiian tourism will receive an unprecedented boost once these essentials again become readily available.

Tidal wave destruction in Hawaii.—Hawaii is still recovering from the destruction and devastation left in the wake of a tidal wave on April 1, 1946, in which 200 lives were lost and property damage amounted to over \$24,000,000. More than 80 percent of the damage centered on the island of Hawaii in and around Hilo. A total of 397 homes were completely destroyed, 961 homes partially destroyed, and 1,300 families were made homeless.

Immediate relief was established in Hilo through the joint operation of the Army, the Navy, the Red Cross and territorial officials. Housing and food were provided for the victims in Hilo at the naval air camp. The Governor appointed a food coordinator and established a revolving fund out of which to buy food, the proceeds from the sale to be returned to the fund to replenish it. The Army and Navy furnished and transported food; the Red Cross had charge of the distribution and feeding.

The Division played a major role in efforts to secure rehabilitation aid for the stricken islands. On April 4, 1946, Delegate Farrington introduced a bill into the Congress to provide relief for victims of the tidal wave. The bill was referred to the Committee on Territories, and negotiations between the Division and other agencies were undertaken to effect the necessary financial aid to the devastated areas. As finally reported out by the committee, the bill authorized appropriations of \$1,300,000 for use by the Federal Works Administration to make grants toward the repair and reconstruction of public works destroyed or damaged by the tidal wave; \$10,000,000 to be expended by the Commissioner of Public Roads for the necessary rehabilitation of roads, highways and bridges, and a fund of \$5,000,000 for the Secretary of the Interior's use for loans to repair and rebuild homes and small businesses. This authorizing bill was passed, and appropriations were approved for the \$1,300,000 for public works and for \$8,000,000 of the \$10,000,000 authorized for roads. No appropriation was made toward the loan fund for rehabilitation of homes and small businesses.

Puerto Rico industrial development program.—Despite material shortages, the Puerto Rico industrial development program went steadily forward. A direct mail approach to interest continental firms in establishing industries in Puerto Rico, for instance, produced almost 600 replies expressing interest in the Company's program of assistance, and the Division extended all possible aid to these groups and individuals.

The glass factory kept the rum industry on normal output, in spite of curtailment of production due to shortages of soda-ash, a glass-making ingredient. Since a large share of the insular government's income is derived from internal revenue taxes levied on rum, this was an accomplishment of considerable importance. Following the Division's encouragement of new industries on the island, construction of a clay products plant was nearing completion, and work started on a small shoe factory as the year ended.

Scarcity of textiles again threatened the life of the island's needlework industry, jeopardizing the income of approximately 60,000 of its workers. The industry was saved, however, from almost complete collapse, when the Civilian Production Administration allotted sufficient materials to the Division of Territories and Island Possessions, at its request, and authorized it to give needed priorities to the needlework manufacturers.

With Puerto Rico in a strategic position as an air center for South America, Africa and Europe, the Division promoted and participated in negotiations leading to increased air service to and from the island. The Civil Aeronautics Board approved applications for routes to Puerto Rico by Pan American Airways, Eastern Air Lines, and Chicago and Southern Airlines, and by the end of the year, besides the certificated airlines, 14 lines were operating nonscheduled or charter flights.

The tourist industry and the Virgin Islands.—The government of the Virgin Islands, the islands' new Governor, and Division officials had, by the end of the fiscal year, formulated plans for the development of the tourist industry in the islands in order to have ready an effective program as soon as transportation and housing difficulties eased. Climatically, the islands are ideal for the tourist industry, with only slight seasonal variations in temperature, and with an abundance of excellent beaches. At present, tourist accommodations in the Virgin Islands are limited, but there is opportunity for large expansion. The economic benefit to the islands, when the revived industry does gather impetus, is obvious, although transportation facilities, particularly by water, had not yet returned to normal at the end of the fiscal year.

The Virgin Islands Company.—Consistent with the purpose for which it had been created, The Virgin Islands Company continued to serve as one of the economic mainstays of the islands. The Company, whose activities are directed toward rehabilitation of the islands, stepped up, as far as possible, its production of sugar and rum during this first postwar year.

Virgin Islands local economy.—The islands' economic situation was aggravated by the necessity for paying high prices for imported goods, while island-produced items commanded low prices. Accordingly, methods of increasing home consumption and export of local output were studied.

Steps have been initiated to better the individual economic security of the Virgin Islands people. Legislation to extend the provisions of titles I,

IV, and X of the Social Security Act to the Virgin Islands was proposed to Congress during the past year.

During the fiscal year, the Congress appropriated \$2,360,005 to make possible first steps in the postwar program for the Virgin Islands, consisting of projected construction by the Federal Works Agency of public works, health and sanitation facilities. The allocation was made under provisions of Public Law 510, approved December 20, 1944, authorizing appropriations totaling 10 million dollars. Material and labor shortages delayed actual construction work, but by the end of the year, bids for various projects had been opened.

Specific services.—The Division not only assisted the territories and islands in attaining their political and economic needs and desires, but also assisted in securing the services of other Federal agencies in meeting and solving economic problems rendered more acute by wartime rigors.

Such cooperation with other agencies, for example, resulted in preventing further sky-rocketing of living costs in Alaska. The steamship companies operating to Alaska for the War Shipping Administration during hostilities stated that they could resume operations for their own account only if freight and passenger rates were revised upward. Any increase at all, let alone those of the magnitude proposed by the companies, would have raised the cost of living in Alaska to an impossible level, since that area is largely dependent on imports of essential items.

Such increases would also have jeopardized seriously the Department's industrial development program for Alaska. Because of the objections raised to the increases on the territory's behalf, the Maritime Commission scheduled hearings on the proposed rates, in which the Division participated. The effective date of the new schedule was postponed until evidence of its impact on the territorial economy could be presented following a study of the situation by territorial agents and counsel.

In the performance of countless services such as this, the Division continued to act as a spokesman for territorial interests before government and private groups, and to make certain that geographic distances did not deprive the territorial areas of the benefits to which they were entitled as citizens of the United States.

Hawaii

Soon after the beginning of the fiscal year Hawaii celebrated VJ-day with the rest of the Nation and then began to attempt to return to normal, peacetime living. The great number of soldiers and sailors predominant in the Territory during the years when it was the greatest base in the Pacific began to be reduced, with resulting reduction in installations and bases. Rehabilitation of war-damaged roads, highways and parks was begun under previously laid plans. Restoration of harbor and wharf facilities and territorial airports was under way.

Wartime controls were lifted from time to time during the year, with almost all of the 151 rules issued by the Governor under the wide powers of the Hawaii Defense Act being rescinded.

The territorial office of Civilian Defense was liquidated as of December 31, 1945, and other volunteer workers such as the Red Cross and the USO resumed peacetime pursuits.

Housing shortage acute.—Lack of housing continued to be one of the major problems of the community. With the assistance of the Federal Public Housing Authority, the Territory made substantial progress in meeting the needs, although seriously delayed by unavailability of materials. At the close of the fiscal year the Hawaii Housing Authority had 1,133 applications for housing in projects built or to be soon available, totaling 2,578 units in Honolulu. Reports for the first 6 months of 1946 show that the average of 116 privately financed homes were constructed a month. Every opportunity has been taken by the territorial government to reconvert barracks and dormitories of military installations located on public lands and no longer needed by the armed forces. The Governor has consistently advocated the opening of additional house lots and present plans of the land commissioner call for the developing of 1,201 lots as quickly as possible.

Employment.—Labor shortages in the Territory have been somewhat alleviated by the availability of discharged service personnel and those who have been separated from Army and Navy projects. The United States Employment Service reported, as of the end of June, that unemployment was practically negligible while they carried approximately 5,000 job openings for the Territory as a whole. Hawaii has experienced practically no unemployment in contrast with the mainland generally. This is reflected by a comparison of the number of claims filed for Veterans' Unemployment Compensation. Of the veterans discharged in the fiscal year in Hawaii, only 4.8 percent filed claims on which an average of \$53.08 a claim was paid. Fifty-seven and seven-tenths of the veterans discharged nationally filed claims paying an average of \$172.

To alleviate the shortage of unskilled agricultural laborers that existed at the beginning of the fiscal year, which had resulted in greatly reduced crops, especially sugar and pineapples, the Governor signed on August 11, 1945, an order permitting the importation of 6,000 Filipino men, the last of whom arrived only 3 days before their homeland became a Republic.

Financial condition.—The financial condition of the Territory is good, partially as a result of the gross compensation and dividends tax. This act was passed by the 1943 legislature at the Governor's suggestion as a stopgap when it appeared that the Territory was facing a large deficit for the next biennium and no agreement could be reached by the legislature as to how additional revenue could be raised. The tax has worked so well that it has been continued in effect. It is believed that it will continue to be an important method of raising revenue.

The legislature of 1943 and 1945 passed two acts, one permitting the transfer of surplus money from the general, revolving, and special funds of the Territory to the sinking fund, and the other appropriating such sinking funds to be used to retire outstanding term and refunding bond issues of the Territory. As a result of these two acts, the outstanding bonds have been reduced from \$34,201,000 on June 30, 1942, to \$14,737,000 on June 30, 1946. Deducting the sinking funds, as of the two dates, the net bonded indebtedness has been reduced from \$23,783,880 to \$9,255,499.

It is difficult at this time to make an estimate as to whether or not there will be a large deficit at the end of this biennium, June 30, 1947. At the close of the last legislative session it appeared that there would be a deficit of at least 9 million dollars. However, tax receipts have not fallen off as expected, and it will be impossible to expend a number of the appropriations due to the impossibility of securing material and labor.

Tax collections for the fiscal year indicate that business is still at a war-time level, in fact exceeding it by nearly 3 million dollars. Twenty-six percent of the \$42,473,900.63 total collected in taxes by the Territory was gross income and consumption taxes.

Statehood.—Hawaii's drive for statehood made rapid progress during the year. A subcommittee of the Committee on Territories of the House of Representatives spent 15 days in Hawaii in January, conducting exhaustive hearings on all the islands. At the conclusion of the hearings, it issued a report recommending that immediate consideration be given to legislation to admit Hawaii to statehood. The President of the United States and the Secretary of the Interior have both issued statements in support of statehood, and the Governor has formed a committee of representative citizens of the Territory to press the issue.

Military government decision.—A decision of the Supreme Court of the United States relative to the validity of convictions of certain civilians by the military tribunals during the period of martial law (military government) following the outbreak of war vindicated those of Hawaii's leaders who had protested the encroachment on their constitutional rights.

Seismic wave of April 1.—In April a seismic wave, attributed to an earth disturbance in Alaskan waters, killed 200 persons and rendered 1,300 homeless when it struck the Islands. Damage to public and private property was estimated to be \$24,000,000. The waterfront area of Hilo, on the island of Hawaii, was virtually wiped out. The Army, Navy and Red Cross assisted the Territory in relieving suffering of the victims and accelerating reconstruction. The Governor set up a revolving fund from which food and building supplies to meet the emergency were purchased directly from the Army and Navy and distributed through normal wholesale and retail channels. Temporary shelter for the victims, especially in the hard-hit windward Oahu and Hilo areas, was found in abandoned Army and Navy camps. Legislation to provide Federal financial assistance to meet the cost of re-

construction was still under consideration in the Congress at the end of the fiscal year.

Health.—The health of the Territory has been good during 1945–46. There have been no major epidemics, and communicable disease has been at a minimum. Two new hospital units, partially financed by Lanham Act funds, were completed during the year and made available 250 additional hospital beds. A shortage of hospitalization facilities for the treatment of tuberculosis victims exists and the Territory is making every effort to care for 200 known active cases needing, but lacking, hospitalization on the Island of Hawaii.

Education.—Hawaii's school system continued to furnish progressive education to its young people. The field labor program, instituted after the beginning of the war, to assist in maintaining the production of vital sugar and pineapple crops, was abandoned in January, 1946. An all-time low of 30 to 1 in the pupil-classroom-teacher ratio was reached during this school year and the importation of new teachers from the mainland for the coming year will reduce this figure still further.

Surplus property disposal.—The Surplus Property Office of the Department of Interior after a long delay in being set up, began functioning fully during the year and disposition of the vast stocks of Army and Navy surpluses began.

Crime.—The crime rate for Honolulu was comparatively low: 1,204 major crimes per 100,000 population for the year 1945. However, there has been a slight increase in juvenile delinquency.

Kulani project.—Despite delays caused by shortage of equipment, progress was made on the Kulani prison camp project on Hawaii. A road has been completed to the area, 5,000 feet high on the slopes of Mauna Loa. With the heavy road equipment now available, the Governor is investigating the possibilities of extending the road to the summit of the peak, which will result in an added scenic attraction. Extensive work has been done in clearing the dense forest at the camp site and an experimental nursery has been planted containing many varieties of fruit trees, nuts, hardwoods and ornamental shrubs.

Puerto Rico

At the end of the first postwar year, Puerto Rico is in fairly good economic position. The boom in construction and the soldiers' unemployment bonus have both helped prevent a sudden disruption of the island's economy. The resumption of normal shipping has brought the value of exports up to an all-time high of \$170,000,000¹ as compared to exports of \$116,203,959 in 1944–45 and the 1940–41 wartime low of \$87,884,324. According to the Department of Labor, wages are the highest ever paid on the island. However, food prices are correspondingly high, showing an

¹ June 1946 estimated at \$12,000,000.

increase of 8 percent for May 1946 as compared with June 1945. While no conclusive figures are available, it is believed that wage increases have not equalled food price increases.

Financial record.—The department of finance estimates total receipts from all sources for the year at \$160,906,679.35, or 19.25 percent more than the previous year. Of this sum, general fund collections were estimated at \$81,224,576.79. This was \$24,000,000 more than the estimate included in the planning board's third 6-year financial program published in February 1946. Rum exports continued to decline and United States internal revenue returns for the year decreased to \$33,216,617.54—11.3 percent below last year. Due to the increasing volume of trade between Puerto Rico and foreign countries, customs duties rose to \$3,439,000—an increase of 59.95 percent over last year.

Industrial progress.—During the year, the land authority acquired the Cambalache sugar mill. Although the inventory of the first year's operation is not completed, it is estimated that profits will exceed \$175,000. The land authority reports that a good start was given to their program of cooperative education among the laborers of proportional profit farms and agregados resettled under title V.

In March 1946 the water resources authority purchased from the Army the floating powerhouse called the "Seapower." This is a self-contained electric power generating plant of high efficiency and with a capacity of 45,000 horsepower of continuous output. It is now being readied for operation and will go into production as soon as its mooring slip is completed.

The Puerto Rico Industrial Development Co. reported increased production in the glass and cement plants. They also reported that a mill for the manufacture of pulp and paperboard was completed and operations started on May 26. Under construction are a clay products plant and a shoe factory, and engineering plans have been submitted for the construction of a textile mill. In January 1946 the Industrial Development Co. began an advertising campaign in the States to interest American capital in Puerto Rico. Over 3,000 inquiries have been received to date, and four continental firms are at the point of inspecting possible factory sites.

Increased production was also reported for the sugar crop which was estimated at 908,246 tons for the year, compared with 886,000 tons for the previous year. Production of tobacco decreased from 400,000 quintals last year, when the crop was overproduced, to an estimated 250,000 quintals for this year.

Agricultural reforms.—In April 1946 the legislature approved an act authorizing the commissioner of agriculture and commerce to determine an insular tobacco production quota, through a referendum of the 23,745 tobacco growers on the island. This referendum was the first of its kind ever held in Puerto Rico. A total of 17,340 of the growers reported to the polls. Of that number, 17,113 voted in favor of the tobacco quota and only 227 against it.

In June 1946 experts in agriculture from various agencies of the Federal and insular Governments attended a meeting sponsored by the Governor and the planning board to discuss and prepare a long-term program to meet the agricultural and land-use problems of the mountain areas of Puerto Rico. Various projects were visited by the group. Papers were presented and discussed covering all aspects of the problems involved. A permanent organization was set up, composed of representatives of the 15 agencies most vitally concerned, to carry out the program agreed on in the meeting.

Department of justice expanded.—Another important development of the past year was the reorganization of the department of justice. The department also initiated a reform of the penal system, including penitentiaries. A system of probationary sentences was instituted for first offenders, and a corporation was set up to provide vocational training for prisoners. The department is also setting up an experimental camp to provide agricultural training for 250 picked prisoners.

Labor.—There were no serious labor disputes during the year. The mediation and conciliation service of the department of labor handled 321 situations, involving 231,989 workers. Of these, only 81 were strikes affecting 25,133 workers and 31 were threatened strikes, with 9,707 workers involved. With the exception of the Bakers Association strike in San Juan, which is still pending, all situations were satisfactorily settled.

In October 1945 the department of labor, in cooperation with the war emergency program, instituted a survey of incidence and duration of unemployment and cost of disabling illnesses, the results of which would serve as a basis for the establishment of a social-security program in Puerto Rico. Figures for March 1946 showed 69,000 unemployed out of a total labor group of 652,000. This is comparable with a census report of March 1940 which showed 66,000 unemployed out of a total labor force of 602,000, or a 0.4 percent decrease in unemployment. Due to the seasonal nature of employment in Puerto Rico, it is believed that unemployment figures fluctuate sharply and are probably at their lowest in the month of March.

Public health.—Progress in the field of public health is reflected in the vital statistics of the health department. The past year showed a record low death rate of 14.1 deaths per 1,000 population. The birth rate increased to 42.3 live births per 1,000 population, compared with an average of 39.9 for the years 1940-44. Leading causes of death remained the same—diarrhea and enteritis first, tuberculosis second.

Education.—The University of Puerto Rico was this year included in the accredited list of the Middle States Association of Colleges and Secondary Schools. A social research center for the study of insular social problems was established at the university, and this year also saw the inauguration of the Itinerant Theatre, an extension activity designed to promote culture and to train dramatic art students.

The university has also inaugurated a veteran's service office. Over 15,000 veterans have been approved as eligible for schooling but owing to the lack of facilities only a small portion of them has been enrolled. Total enrollment in all Puerto Rican schools during the school year was 380,095, an increase of 6.88 percent over last year. The work of the department of education was handicapped by the delayed appointment of a commissioner. The department operated throughout the year under an acting commissioner.

In March 1946 the office of information—through the Federal Radio Education Committee—started circulation in Continental schools of the six 15-minute documentary recordings called "This is Puerto Rico." Over 50 sets of the recordings are being rotated, together with a portfolio of material which is kept by the teacher. Early reports from the Federal Radio Education Committee indicate that exceptional interest is being taken by schools in these recordings.

The Puerto Rico Handbook 1946 was published during the year and distributed to a wide list. This book was designed to answer any ordinary question concerning the island. In October 1945 the office began the accumulation of a library of documentary photographs which will eventually cover all aspects of life in Puerto Rico. Well-known photographers are being employed to make the photographs and the library at the end of the year consisted of 2,000 pictures. In May 1946 the office started work on a documentary motion picture of Puerto Rico, to be distributed in the States.

Legislation.—The Governor approved 514 bills passed by the Legislature, to continue and enlarge the islands' health program, to provide substantial sums for construction and equipment of medical centers, municipal hospitals and rural health centers, and to make possible slum clearance projects. Money was also appropriated for a training school for nurses' aid and for medical scholarships, and an act was passed authorizing the commissioner of health to contract for the services of outside physicians to fill vacancies in the department of health.

The Puerto Rico planning, urbanizing and zoning board submitted to the Governor and the legislature the third 6-year financial program—for the year 1946–47 to 1951–52. The program calls for total expenditures of \$395,785,053, of which \$287,220,543 were assigned for current expenditures, \$54,925,300 for capital improvements of tax-supported agencies, \$47,162,873 for contributions to public enterprises and the rest for service on proposed and existing public debt. Almost all the recommendations for 1946–47 were approved by the Governor and the legislature.

Other important legislation provided for: the establishment of the coffee industry relief commission; the creation of the soil conservation committee; the incorporation and control of cooperative associations; subsidies for coffee

growers; authorization for the Governor to acquire airports and/or airport facilities; a continuing appropriation to the Puerto Rico communications authority for radio broadcasting facilities; creation of the insular veterans bureau; and an appropriation to establish three free schools of music.

Alaska

VJ-day, signaling the end of the second World War, came close upon the beginning of the fiscal year 1946. With the coming of peace, Alaskans looked forward to a great influx of prospective settlers, including many ex-servicemen to whom Alaska appeared to offer opportunities in an undeveloped, sparsely populated part of our country. The Alaska development board, created by the 1945 legislature, was devoting a considerable part of its activity to compiling and issuing informative literature of all kinds in order to make known to prospective comers the conditions that they would actually face in Alaska. The most serious handicap which would confront every one of them and the greatest obstacle to increasing the population of Alaska through its new arrivals was the acute housing shortage, which in many communities made the absorption of newcomers virtually impossible. This shortage likewise inhibited the starting of even small new businesses, since employees coming from the States would have no place to live.

Veterans benefits.—With the war ended, the returning veterans naturally were deemed of first concern. The Federal Veterans' Administration established a regional office in Alaska early in the calendar year 1946. The benefits presumably provided by the various Federal veterans' acts were, in fact, not available to returning Alaskan servicemen. Not a single loan had been made in Alaska to a veteran under the GI bill of rights. The Governor therefore called a special session of the territorial legislature for two primary purposes: Veterans' legislation, and to make additional appropriations for public health measures, especially tuberculosis, which has increasingly become a serious menace in the Territory.

The legislature, convening for 30 days, enacted a veterans' bill which may fairly be considered among the best legislation of its kind as yet passed by any State or Territory. It provided a bonus of \$10 a month for every month of service; it provided loans of various characters: Loans up to \$2,500 for educational and personal purposes, and up to \$10,000 to enable the veteran to acquire or build a home or farm or to initiate or buy a business or other revenue-producing enterprise, such as a fishing boat. (If a veteran elects to take the bonus, he cannot have a loan, unless he repays the bonus.) It was felt that not only would this legislation bring direct, quick and tangible benefits to the veterans themselves, but would greatly aid in stimulating the economy of Alaska. As the veterans repay the loans, the interest and amortization go into a revolving fund. A veteran, after repaying one loan, as for business purposes, may borrow again for further business development, or for building or buying a home. The interest rate

is 4 percent on all loans—contrasting with the generally prevailing Alaskan rate of 8 percent.

The special session of the legislature likewise appropriated \$250,000 for the care of tuberculosis patients for the ensuing year, a sum which contrasted favorably with the \$30,000 annual appropriation made at the regular session 1 year previously. The Territory had meanwhile acquired the former military, 150-bed hospital at Seward which had been declared surplus to the needs of the Army.

Transportation.—The most serious threat to Alaska's economy for a generation came with the call by the War Shipping Administration of a hearing for the purpose of increasing freight and passenger rates on the Alaska carriers. The War Shipping Administration, desirous of turning these ships back to private operation, had been informed by the operators that they would not take them back unless rates were increased approximately 100 percent. Rates to Alaska were already extremely high and had, in the past, been the subject of repeated protests from Alaskans. Alaska's economic lifeline has for years been maritime transportation from Seattle. But Alaskans have had no control whatever of the character of the service or over the rates which, at not infrequent intervals, had been arbitrarily raised. It should also be pointed out that the steamship business, as far as Alaska is concerned, has been a virtual monopoly.

Since the annual steamship bill for Alaska freight and passengers may be estimated in the neighborhood of 8 million dollars, the proposed increase of a like amount would, on the assumption of there being some 20,000 families in Alaska, levy a tax of some \$400 per family, and with no collateral benefits whatever. A thorough study, for the first time, was made of the economics of waterborne transportation, and the newly accumulated facts and figures were presented at subsequent hearings. At the same time the Congress, through the House Committee on Merchant Marine and Fisheries, became definitely interested in the problem of Alaska waterborne transportation. The consequence was that at the end of the fiscal year the prospect of a defeat of the proposed rate increases loomed encouragingly, and work and planning continued among the Alaska development board, the steamship operators and a specially appointed subcommittee of the House Committee on Merchant Marine and Fisheries, looking to a permanent solution of the problem.

While substantial and gratifying progress was being made toward a long-range solution of Alaska's transportation difficulties, an immediate transportation crisis, brought about by an intermittent and steadily lengthening series of strikes and work stoppages among the maritime unions and waterfront workers, laid a crippling hand on Alaska. The months of April, May and June, the last 3 months of the fiscal year, are the crucial months in the preparation for Alaska's seasonal industries—mining and fisheries. It is during these months that supplies and materials are borne northward to

take care of the season's, which means the year's operations. Delay of cargo at this period means either a serious impairment or a complete closure of the activities dependent upon these supplies. The maritime work stoppages did irreparable damage to Alaska at a time when it was trying to gear itself to peacetime activities. Gold mining, interior Alaska's great industry which was suspended during the war years and whose resumption was confidently anticipated, proved to be almost negligible in the first postwar season.

The lack of steamship service also greatly affected the labor supply, since airborne traffic was likewise wholly inadequate. Other industries beside fishing and mining, notably construction (and especially housing)—urgently needed after 5 war years were similarly checked or nipped in the bud. This situation increasingly calls the attention of Alaskans to their dependence on water transportation and the vulnerability of their position in their having no real alternative transportation adequate to their needs.

The prolonged and continuing maritime tie-up further emphasized the steadily increasing importance of air transportation, which to a limited, but nevertheless ever-increasing extent, could be counted upon to diminish in some degree the acuteness of the hardships brought about by maritime paralysis. The Department and the Alaska development board had, during the year, taken an active part in the so-called Pacific Case before the Civil Aeronautics Board, which was to determine the routes and carriers from the United States to the Orient. The Department strongly endorsed the report made to the Civil Aeronautics Board by its examiner and public counsel, which recommended a route from Alaska overland to the Middle-west and an additional Alaska carrier to be certificated from Alaska down the coast to Seattle.

Industries.—The tourist industry is the greatest potential field of undeveloped activity in Alaska. The Territory's economy is and has been woefully lopsided, having consisted for the last half century of only mining and fisheries, the former almost wholly gold, the latter chiefly salmon. In every State of the Union and the sister Territory of Hawaii, as well as in other countries, the tourist business has become an increasingly important and expanding economic resource. Alaska's superlative scenery, its matchless sport fishing, its wildlife, the native arts and crafts, all combine to make it ideally suited for tourist development. The big deterrant to an immediate boom in Alaska's business is the lack of adequate transportation and hotel accommodations.

Serious concern has been aroused in recent years over the apparent diminution of Alaska's abundant fisheries and wildlife. While various factors are ascribed to this threat to Alaskan economy, since fisheries are its first resource and furs its third, there is universal agreement upon the inadequacy of appropriations for the necessary enforcement officers. It is literally impossible to police against poachers the fisheries and the wild-

life—both under Federal control—with the small staff provided by congressional appropriation. Moreover, further intensive research, for both fisheries and wildlife, is equally required to learn the habits of the species and the causes for variation in the runs, both as to time and size.

The Virgin Islands

Political.—This year, on the tenth anniversary of the present constitution of the Virgin Islands, the Organic Act of June 22, 1936, the people of the Virgin Islands reviewed a noteworthy record of effective local government under universal suffrage and other democratic political institutions established by that Act. Moreover, they looked forward to the continuing evolution of their democratic institutions as justified by this ten-year record and as advocated by the President this year in his annual message to Congress when he said, "The people of the Virgin Islands should be given an increasing measure of self-government."

Inauguration of new governor.—On the occasion of the inauguration of the fourth civilian Governor, William H. Hastie, on May 17, 1946, Virgin Islanders took pride in the significant fact that their own views had been received, fully considered and given effect by the Senate Committee on Territories in connection with the confirmation of the new Governor. It was also a source of much gratification to the community that the Secretary of the Interior and other ranking representatives of Government from Washington, by their presence in St. Thomas on the occasion of this inauguration, and the President by his special message to the Governor and the people on the same occasion, further demonstrated the national concern with the advancement of the legitimate interests and aspirations of the inhabitants of the outlying possessions of the United States.

Economic.—The economic life of the islands is based on the bunkering activities of the port of St. Thomas, the manufacture of beverage spirits in St. Thomas and St. Croix, and the sugar industry of St. Croix. This year showed a steady improvement in shipping to St. Thomas. A total of 353 ocean going vessels, with gross tonnage of 1,493,725, visited St. Thomas, as compared with 204 vessels with gross tonnage of 264,640 in 1945 and prospects are good for continued improvement. St. Croix' basic industry, sugar, showed a production increase from 4,040 tons in 1945, to 4,970 tons in 1946, due to increased acreage and acre-yield and to improved processing. St. Croix exported 137,608 proof gallons of rum and liqueurs in 1946, as compared with 129,082 proof gallons in 1945. St. Thomas exported 817,441 proof gallons in 1946 as compared with 1,340,208 proof gallons in 1945.

The rum and liquor industry, upon which these islands have depended during the past few years for their major source of revenue and for private employment of wage earners, has suffered a severe curtailment of production during the year because of Federal conservation orders. Still

the largest single industry in the islands, rum manufacturers were turning more and more, as the year closed, to the still unrestricted manufacture of whiskies, gins, and liqueurs from neutral spirits for the continental American market.

Public works program.—With appropriations totaling \$2,360,005, already made by Congress for the projected construction by the Federal Works Agency of public works, health, and sanitation facilities authorized by Public Law 510, approved December 20, 1944, no major construction project had been started by June 30, 1946. The first bids opened late in the year for sanitation facilities for St. Thomas were rejected, and the projects readvertised. Prospects for an early start of construction of these urgently needed facilities are not bright in view of unsettled conditions in the entire building and construction industry.

Health and sanitation.—The general health of the islands has been good and there were no epidemics, despite the primitive sewage disposal methods for large parts of the community. The legislative assembly adopted a rigorous milk control law to become effective on July 1, 1946, but at the end of the year it appears that strict compliance will not be achieved for several months. Federal public health grants were available for general health training, tuberculosis control, and venereal-disease control. These grants have become a major factor in the development of an aggressive program in the public health field.

Finances.—The revenues of the municipality of St. Thomas and St. John were \$1,112,002.07 as compared with \$1,257,416.53 in the preceding year. In St. Croix, revenues were \$262,257.54 as compared with \$515,383.28 a year ago. Congress appropriated \$150,000 toward the expenses of local government in the municipality of St. Croix. Financial and economic trends do not indicate any unusual revenue increases in the coming year. Indications are that in the municipality of St. Thomas and St. John, the peak of wartime income has passed and that ways and means must be found to provide the best possible municipal services without further budgetary increases. In St. Croix, Congress has provided for a study of the municipal government by three municipal experts, under the supervision of the Committees of the Senate and House on Appropriations, to formulate a policy as to future assistance from the Federal Government.

Social welfare.—Efforts were concentrated on the securing of improved municipal appropriations for aid to the poor and on the obtaining of Federal aid for supplementary public assistance and welfare services, through the extension to the Virgin Islands of titles I, IV, V, and X of the Social Security Act. This legislative reform has not yet been achieved, although there is no area under the flag where American citizens are in greater need of such assistance from their government.

Education.—The public school program has been maintained with senior and junior high schools, elementary schools, in-service teacher training,

scholarship loans, evening schools for adults, limited vocational education, and school lunch and nursery school programs. In St. Thomas and St. John the average annual expenditure for public education per child was \$66.50. In St. Croix the cost was \$52.40.

Military services.—Throughout the year there has been a constantly accelerating withdrawal of personnel from all military establishments in the Virgin Islands until at the year's end all installations are reduced to essential maintenance personnel. Of approximately 800 Virgin Islanders who were conscripted for military service, 650 had been demobilized and returned to the islands by June 30, 1946. These figures do not include Virgin Islanders who were conscripted in the United States and those who voluntarily enlisted.

Legislatures.—During the year the executive approved a total of 137 bills passed by the municipal council of St. Thomas and St. John, 42 bills passed by the municipal council of St. Croix, and 11 bills passed by the legislative assembly. A total of 11 bills were vetoed. Two bills were re-passed over the Governor's veto, one of which, an increase in wages and decrease in working hours, was sent to the President for his decision.

Organic Act revisions.—A committee set up under local legislation submitted to the Governor its report recommending revisions in the Organic Act of 1936. The most significant recommendations included a single legislature for the islands to meet annually in 60-day sessions, the removal of the power of the Governor to send bills passed over his veto to the President for final decision, the creation of a single treasury, and establishment of the office of resident commissioner in Washington. The proposals will be placed before the Congress during the coming year.

Equatorial Islands

Under existing statutes and Executive orders, the Secretary of the Interior is responsible for the government of Baker, Howland, and Jarvis Islands (under United States sovereignty) and Canton and Enderbury Islands (under the joint sovereignty of the United States and Great Britain). Because of their location, these islands are of special importance to the Government of the United States in connection with aviation and meteorology.

The Philippine Islands

As the Philippines were scheduled to receive their independence shortly after the close of the fiscal year, the Division cooperated with Philippine officials in preparing for the withdrawal of United States sovereignty from the islands. The disbursing functions, which the Division had performed at the request of the Philippine Government, ceased and arrangements were made for the transfer of the funds and securities on deposit with banks and with the Treasury Department to the new Republic of the Philippines.

Puerto Rico Reconstruction Administration

EDWIN G. ARNOLD, *Administrator*¹



OPERATIONS of the Puerto Rico Reconstruction Administration during the fiscal year have been confined principally to protection of investments previously made and to conservation of the most essential features of its former broad program of rural rehabilitation. Its projects have been substantially the same as those for the preceding four years during which activities have been financed exclusively with sums allotted by the President out of the Puerto Rico revolving fund created by the act of February 11, 1936 (49 Stat. 1135), and consisting of income and the proceeds of the disposition of property derived entirely from PRRA's operation of projects which were financed with funds originating in the Emergency Relief Appropriation Act of 1935.

Expenditures on approved projects totalling \$1,024,000 (including unobligated balances of \$112,700 from the previous fiscal year) were approved by the President, leaving a net balance of approximately \$2,927,000 in the revolving fund as of June 30, 1946. From this balance and anticipated accretions to the fund the President has thus far authorized PRRA expenditures for the fiscal year 1947 totaling \$776,500.

Rural rehabilitation and housing.—PRRA built 281 rural houses during the fiscal year on 843 acres of formerly unproductive land now devoted to raising subsistence crops to eke out the meagre income of the resettled farm-laborer occupants. From these new houses, the 6,409 rural houses and 1,210 urban family dwelling units previously constructed, and the nominal rentals of some 4,400 small parcels of land without houses, the office of housing management collected \$383,700 as against outlays authorized for management and maintenance of \$254,300. All of the urban units and 97 percent of the rural homesteads were occupied on June 30, 1946. Under the policy of encouraging tenants to become owners, 356 monthly occupancy agreements in the urban zones and over 5,500 in the rural districts had been converted by June 30, 1946, to liberal discount long-term purchase agreements.

¹ Appointed by Executive Order No. 9618 of Sept. 19, 1945.

Closely tied to the rural housing developments, the activities of PRRA's seven Central Service farms and PRRA agronomists' free advice and supervision of resettlers' cultivating, harvesting, and marketing practices, resulted in the planting of approximately 14,000 acres of varied subsistence crops and 4,500 acres in cash crops on lands of the Federal Government occupied by PRRA resettlers. The 1,100-acre Castaner farm operated by PRRA to demonstrate that a coffee plantation can be made self-supporting by proper crop diversification, produced \$54,506 from sale of citron, coffee, sugarcane, and various minor crops against authorized expenditures of \$53,950, while furnishing employment to the members of more than 200 resident families.

Cooperatives.—In the continuation of the long-established program of assisting in the organization, financing, and guidance of cooperatives, PRRA last year gave special attention to those which market agricultural products. Of such, two additional cooperatives were organized with PRRA advances totaling \$29,000, and with the five similar vegetable marketing cooperatives previously financed, they had a gross income of approximately \$657,000, compared with last year's total of \$500,000, despite continued poor marketing conditions and shipping problems. A contract was also made for a \$20,000 loan to a Central Cooperative to serve other marketing cooperatives, which received its charter on June 29, 1946.

The Citron Cooperative is now experiencing more difficulties than any other sponsored by the PRRA, having about 700,000 pounds of citron in brine in the process of curing, for which there seems to be no demand, largely because of sugar restrictions. The Puerto Rico Rug Cooperative with better designs and outlets increased its last year's volume of about \$122,000 to approximately \$345,000. The Resettlers' Rug Cooperative, organized and financed during the fiscal year with a PRRA loan of \$44,000, had sales of \$38,350 since starting operations late in the spring. With payments respectively of \$265,405 and \$30,270 including interest, the Sociedad Agricola and the Cotton Growers' Cooperative discharged their PRRA loans in full. Likewise the Lafayette Sugar Mill Cooperative, as a result largely of successful operations in its subsidiary solvents plant the previous year, repaid during the fiscal year 1946 \$500,000 of PRRA advances several years in advance of their due date, and on June 30 paid the interest then due on the remaining principal balance of approximately \$2,500,000.

The Los Canos Sugar Mill Cooperative likewise paid its amortization installment due June 30. Lafayette, due to the cessation of lend-lease and war contract demands for butyl alcohol and acetone, has not operated its solvents plant during the fiscal year, but has ordered equipment for conversion to the production of industrial alcohol. In its sugar operations, Lafayette ground about 35,000 tons more of cane than the previous year, and led all other mills of the island in "yield." Los Canos, however, ground approximately 50,000 tons less than the previous season, due partly to short-

age of fertilizer, unfavorable weather, and affiliation of some colonos with other mills.

Eventual liquidation of PRRA.—Even on the basis of its present limited program, it will be a matter of only a few years until the revolving fund is so depleted that adequate financing cannot be continued. Administrative expense of a still more restricted program would be disproportionate to its accomplishments. How PRRA controlled properties and administration of its projects might be transferred to the insular government, with due regard to the value of the remaining Federal investments and on terms which would assure furtherance of the Federal program's objectives, is the subject of current studies. However, no definite plan is yet ready for submission.

Surplus Property Office¹

JOHN M. BARRINGER, *Director*



THE Department of the Interior, on May 10, 1945, was designated by the then Surplus Property Board (now the War Assets Administration) to be the disposal agency for certain war surpluses located in the territories and island possessions. In turn, the Secretary of the Interior, by departmental order, authorized the Division of Territories and Island Possessions to carry out the Department's functions in that respect. For this purpose, the Surplus Property Office was originated, headed by a Director in Washington, with additional offices, each under the direction of a territorial surplus property officer, in San Juan, Puerto Rico; Anchorage, Alaska; and Honolulu, T. H.

The first objective of the Surplus Property Office disposal program was to supply fully the needs of territories and island possessions; the second, to find outside markets for the overflow.

In carrying out its functions, the Surplus Property Office was guided throughout the fiscal year by regulations and policies established by the Surplus Property Board and its successor agencies in accordance with the Surplus Property Act.

Organizing occupied several weeks following the activation of the Office. During that period, field operations were outlined and necessary forms were prepared and printed.

On June 30, 1946, the Surplus Property Office had 425 employees. Of these, 74 were in the Washington office, 104 in Alaska, 177 in Hawaii, and 70 in Puerto Rico.

By the end of the fiscal year, net acquisitions of surplus property turned over to the office by owning agencies totaled \$157,470,846.50. This was the original cost of the property to the Government, as declared by the owning agencies. This total included surplus real property amounting to \$19,930,925 at reported cost.

¹ On October 15, 1946, Secretary Krug issued Order No. 2265 recreating the Surplus Property Office as a unit independent of the Division of Territories and Island Possessions.

During the year, the surplus real property in the territories and island possessions was turned over to the General Land Office (now Bureau of Land Management) for disposal.

Sales during the fiscal year ending June 30, 1946, totaled \$56,338,281.24 at reported cost to the Government. Realization, or money received and turned in to the United States Treasury, was \$17,903,374.45 during the year. Obligations of the Surplus Property Office during that period totaled \$1,268,978.73, or 7 percent of the realization on the property sold.

Board on Geographical Names

MEREDITH F. BURRILL, *Director*



DURING the fiscal year 1946, the Board on Geographical Names made significant progress in extending, clarifying, and rationalizing fundamental policies. Both the Division of Geography and the interdepartmental Advisory Committee that together constitute the Board have contributed to this program, the former through formulating policy statements in the light of current experience and over-all needs; the latter by review in the light of past experience and the special problems of the several agencies represented.

The Board has continued to extend and to elaborate the basic principles upon which its name decisions are based, with particular attention to the application of the names of persons to natural features, and to the names of Antarctica. These policy statements are doubly useful. They aid the Board in impartial and unbiased consideration of controversial cases, and they aid individuals in selecting appropriate names for recommendation to the Board, a matter of particular importance to the explorers of uninhabited regions. The procedures accompanying these policies, providing for explicit areal application of names, should assist materially in rationalizing nomenclatures heretofore often unordered and confused.

The Board during the year developed and adopted an improved form for use in the promulgation of its decisions, which should be of material assistance to map makers and other frequent users of such decisions. The form allows for a more complete statement of the circumstances surrounding the decision which in turn will facilitate an understanding of the bases on which that decision has been rendered.

The Division has counseled with all of the active Federal mapping agencies and has provided special and general aid and information in the solution of name problems as encountered by those agencies. During the year the Division has undertaken the preparation of directions for use by mapping agencies in the treatment of great numbers of geographical names in various areas of the world. Primary emphasis in this program has been on Latin American areas, and a series of such publications with cumulative lists of names approved by Board decisions will be ready for distribution in the next fiscal year.

The Board has continued its examination of the various map languages of the world. With the assistance and cooperation of interested Federal agencies the Board prepared a standard transliteration system for rendering the Arabic alphabet in Latin letters. Continuing study is being given to the modifications of the standard Arabic system that are required for the Persian language. The unique file of Mongolian name materials developed by the Division has increased during the year to the point that the Division is able to provide standard names for use on maps of Mongolia as required.

The master card file of standard names more than doubled in size during the year. It now contains nearly 3 million names, about half of which have full cross references from the numerous variant forms to the standard name. Considerable work is still required to incorporate the large number of cards supplied by other agencies cooperating with the Board. With this increasingly valuable resource the Division during the year answered over 6,000 inquiries received from nearly threescore Government offices and from a large number of business firms and individuals. By serving as a ready reference point for the answering of troublesome questions concerning geographical names this operation represented a saving of thousands of dollars to the Government alone.

The Division continued to edit geographical names appearing on the maps and in the texts published by the various Federal agencies, achieving in these instances the consistency of name usage so necessary in the publications of the Government. This editing process is based upon the names contained in the master file and on procedures developed within the Division for securing additional names not in the file at the time of editing. These new names, processed in the absence of such names in the file, become a part of the file and are thus usable in subsequent editing.

In all these matters the Division of Geography has worked closely with the Advisory Committee of the Board. The membership of the Advisory Committee on June 30, 1946, consisted of representatives from the following agencies and organizations: Government Printing Office; Library of Congress; State Department; Office of the Chief of Engineers, War Department; Military Intelligence Service, War Department; Post Office Department; Hydrographic Office, Navy Department; Forest Service, Department of Agriculture; Bureau of the Census, Commerce Department; Coast and Geodetic Survey, Commerce Department; Geological Survey, Department of the Interior; National Archives, the National Geographic Society; American Geographical Society of New York; the Geographic Society of Chicago; and the Geographical Society of Philadelphia.

Heavy demands on the Division's services continued unabated throughout the year following the Japanese surrender, and the rendering of such services proceeded up to the limits of available funds. There is increasing evidence that the needs for technical and scientific geographical name information will be even greater in the future than during the war. Increas-

ing concern of this Nation with other parts of the world has greatly expanded the importance of such information. Although material progress has been made during the war years in filling the wide gaps in this country's available knowledge of foreign nomenclatures, much more remains to be done than has been accomplished. The inadequacy of information on the geographical names within our own country must continue to be a source of grave concern, and it is imperative that measures be taken to provide this information.

Division of Personnel Supervision and Management

MRS. J. ATWOOD MAULDING, *Director*



WITH the end of the war there was naturally an abrupt shift in the labor market and whereas recruitment had previously been difficult in practically all occupational groups there are now an increasingly large number of applicants. This shift is exemplified by the increase in the number applying in person to the central personnel office alone from practically a handful a year ago to over 700 last month. With the release of the men from the armed services our own furloughed employees have been coming back and at the end of the fiscal year approximately 4,500 have returned to the Department. Some others have chosen employment elsewhere. There are still around 2,700 who have not been released or have not yet applied for reinstatement. In addition there have been available for placement those in liquidating and contracting war agencies in the Department.

In March a large part of the examining and recruiting work of the Civil Service Commission was transferred to the operating departments by Executive Order 9691 with authority to make employments pending the establishment of registers. Thus the Departments were called upon, on 30 day's notice, to establish machinery for systematic recruitment and certification, with required priorities for veterans and former employees. For the establishment of permanent registers provision was made for the creation of committees of experts to handle examinations for professional and scientific positions peculiar to the Department, and for boards of examiners in the field to meet the needs of the various Bureaus. While in accord with the philosophy of more active participation in the framing and holding of examinations, the Department and the Bureaus have been handicapped by having to undertake this work on short notice without adequate provision for additional personnel. In connection with the recruitment process contacts have been made with the United States Employment Service, veterans' organizations, private and public schools and colleges, professional associations and other Government agencies. In filling vacancies the Department's policy has been to give first consideration to its returning veterans and second to qualified employees affected by liquidation. This

has involved considerable placement work across Bureau lines by the central office.

It is interesting to note that in the 5-month period prior to this report the Department entered on duty over 10,000 veterans. This number includes both former Department employees and new veterans. They are now being added to the Department at the rate of about 2,000 per month. Of course, normal turn-over takes place; but the latest record shows that nearly 30 percent of the total personnel of the Department are veterans. On his return the veteran is given his old job back or a better one if it is available and he is qualified for it. While budget and organization restrictions have prevented a higher grade in some cases, we have been able to give higher grade jobs to a substantial number.

During the war employee training came into its own. At one time regarded in some quarters as a luxury, training has now proved its own case as a necessity, not only to bridge the gap between formal schooling and job requirements, but also to inculcate knowledge and foster ability in new activities for which established schools are not yet prepared. In this Department in-service training has seen a noteworthy extension. Of special significance in this connection is the promulgation during the year of a Statement on Training in the Department of the Interior. This was followed by the issuance of A Supervisor's Guide to Employee Training developed by the Training Section in collaboration with outstanding departmental supervisors and designed to assist all practicing and potential supervisors to analyze work loads, identify production and personnel "lag," determine training needs, select appropriate kinds and methods of training, and to call upon bureau or departmental training personnel for advice and counsel in setting up needed programs.

During the year the Department concluded with the Veterans' Administration formal working agreements covering the training of veterans under Public Law 16 (rehabilitation of vocationally handicapped veterans) and Public Law 346 (the so-called GI Bill of Rights). These agreements have been promulgated throughout the Department with instructions for carrying them into effect wherever such training is shown to be in the interest of operations and veterans.

In the departmental training office the following established training projects continue: Shorthand refresher courses; typing refresher courses; secretarial practice classes; orientation on the departmental level; supervisory training program; administrative training program.

In the classification field the retrenchment in war work and the expansion of the postwar program increased the activities. Classification surveys have been made in several of the Bureaus and a total of 210 working days were spent in the field in connection with field-office organizations. A total of 4,567 positions were allocated during the year, 1,368 of which were in the departmental service and 3,181 in the field service.

The Standards and Specifications Section has had its first full year of operation. The coordination of the standards work of the Department with the work of the Civil Service Commission is of first importance and has done much to unify the thinking within the Department in the standards program. All of the jobs in the field service have been coded in accordance with the Commission's Handbook of Occupational Groups and Series of Classes. For those positions which are not defined in the Commission's handbook, this office has established its own code numbers and definitions as a temporary expedient until such time as the Commission completes its survey and amends its handbook.

The basic policies governing wage fixing for employees of the Department as enunciated in Secretarial Order No. 1989 of September 8, 1944, were continued. A total of 33 wage boards, established by the Secretary, functioned during the year for the various Bureaus in the Department. In May and June 1946, public hearings were held by the Southwestern Power Administration Wage Board and by the Bureau of Reclamation Wage Boards for the Columbia Basin project, the Klamath project, the 3 divisions of the Central Valley project, Boulder Canyon and Parker Dam projects, and for the All-American, Gila, and Yuma projects. In addition wage conferences were held by the Bureau Wage Boards at Denver, Boise, and Amarilla for field officials and other interested personnel who were not involved in the public hearings mentioned above. The Division of Personnel Supervision and Management was represented in all of the hearings and conferences and determinations of the wage schedules. Effective June 3, 1946, the Secretary granted authority to the Director of Personnel to approve wage rates and on June 5, 1946, to approve overtime.

All evidence indicates that the morale of the Department's personnel is high. The number of grievances filed have been few and only 31 efficiency rating appeals have been presented for adjudication to our 2 Boards of Review located in Washington and Chicago.

Information regarding recreational opportunities, housing, group insurance, and health hints has been disseminated. Welfare and credit services have been available. The hostess group has been carried on with the assistance of the bureau counselors and personnel officers. Its work has been tied in closely with the Interior Department Recreation Association, the activities of which have been stimulated and enlarged as a result of reorganization and departmental promotion. A series of talks by Bureau heads to our employees regarding the work, function, and scope of each of the Bureaus has been instituted, looking to a better informed personnel.

In line with the long-range program for decentralizing operating responsibility as fast as practicable to the Bureaus, there was delegated to the Geological Survey in September 1945, authority for handling all field personnel actions below grades CAF-11 and P-4. The authority of the Bureau of Reclamation, Bonneville Power Administration, and South-

western Power Administration was also extended to include field positions in grades P-6 and CAF-13. The maintenance of retirement records was recently transferred to the Bureaus in Washington. During the year 13,257 actions were processed in the Division, and 35,518 actions by the Bureaus were post-audited.

At the close of the fiscal year the Department had 51,330 compensated employees, 4,694 in the metropolitan Washington area and 46,636 in the field service. In addition there are 1,586 uncompensated personnel.

The staff of the Division has aimed all of its activities toward rendering grater service to the operating Bureaus and acting in an advisory capacity on departmental personnel policy. It is felt that the staff has increased the measure of good will within the Department, which is a factor toward maintaining high morale.

Departmental Safety Program

FRANK L. AHERN, *Departmental Safety Engineer*



THE OFFICE of the Departmental Safety Engineer was established during the year for the purpose of assisting the different Bureaus of the Department to establish and improve their safety programs and thereby reduce the number of employee accidents and control fire losses in buildings under the jurisdiction of the Department. The Department's program, in addition to employee accident prevention and the protection of public property, includes in some cases, public safety as well.

The Bonneville Power Administration has had a safety program since 1940 and that program is being reviewed to make it more effective.

The Bureau of Mines, internationally known for its work in safety with industry, added a safety engineer to its staff for the purpose of reducing employee injuries and for the protection of public property.

The Bureau of Reclamation, which has also had a safety program since 1937, prepared plans for more intensive work in accident prevention in its field operations.

The National Park Service continued the program which it established in 1937.

The Fish and Wildlife Service has taken steps to obtain authorization for a more intensified program in its Service.

The Departmental Safety Committee, composed of one representative each from the different bureaus of the Department, has produced a new edition of the Motor Vehicle Regulations and Safe Driving Practices for the Operation of Motor Vehicles by Employees on Official Business. These regulations are in accord with the President's program for the reduction of automobile accidents nationally.

The Department is represented on interdepartmental organizations, including the Federal Fire Council and the Federal Interdepartmental Safety Council and on committees of national scope relating to matters of safety standards.

This report is submitted as one of progress. In future reports it is expected that results will be presented that are satisfactory to the Department and in the public interest.

Interior Department Museum

H. L. RAUL, *Museum Curator*



THE Interior Department Museum has entered upon its ninth year since its dedication. During this period it has continued to visualize to the public the history, aims, and activities of the Department's 97 years of vital services to the Nation. Visitor comments frequently stress the effectiveness of its logical arrangement and selectivity of exhibits, and the supporting information set forth in the descriptive labels and in the material at the information desk which serve to reinforce visitor interest in the activities of the Department.

Attendance and Foreign Visitors

During the past year approximately 48,000 persons visited the museum. Visitors were recorded on the visitors' register from all States in the Union. Registrations were received also from Alaska, Hawaii, and Puerto Rico. Foreign registrations were from Argentina, Australia, Belgium, Bolivia, Brazil, British West Indies, Canada, Chile, China, Costa Rica, Cuba, England, France, Guatemala, Italy, Mexico, New Zealand, Norway, Panama, Peru, Philippine Islands, and Romania.

Victory Exhibit

A retrospective exhibit portraying the Department's participation in the successful prosecution of the war is permanently installed in the foyer of the museum. Installed in case No. 1 is a service flag especially designed in display materials with numerals for 8,092 blue stars and 150 gold stars, signifying the magnificent record of employees who served and those who died while in the armed forces during the war. In cooperation with the Division of Personnel and Management, 2 panels carry the individual names of those who gave their lives. Beneath the service flag and supporting it is mounted an enlarged official seal of the Department signifying the participation of all departmental employees in activities supporting the victorious war effort.

Opposite the service flag which pertains to personnel in the war is placed a large display panel consisting of eight sections which carry general information relating to the many essential activities pursued in the war program of the Department in administering the vast resources of the Nation in metals, oil, power, fuel, helium, food, land, water, and timber as war materials.

Collaboration With Bureaus

A large relief map of the United States, 66 by 33 inches, and a revised topographic map of Washington and vicinity, 54 by 44 inches, both maps engraved and printed by the Geological Survey, were installed in the museum. A printed exhibit pertaining to Indians in the war was placed on permanent display in the gallery of the Office of Indian Affairs. This material lists such data as awards for valor, Indians on Iwo Jima, those who gave their lives, wounded in action, and Indian Service employees in the war. Numerous display cases throughout the museum have been and are being revised, in collaboration with the Bureaus, in line with the historical purposes of the retrospective victory exhibit and to reflect current activities.

Cooperation With Other Agencies

Cooperation has been given upon request to numerous organizations. Museum lecture tour service was extended to representatives from the embassies of allied countries, including Belgium, China, Czechoslovakia, Finland, Great Britain, France, Greece, Italy, Netherlands, Norway, Commonwealth of Philippines, Poland, Russia, and Yugoslavia, acquainting the cultural attachés of the various countries with the responsibilities and accomplishments of this Department. A like service was accorded to a group of officers of the Chinese Army working with the General Staff in Washington, who visited the museum particularly to study the exhibits of the Bureau of Reclamation, the Geological Survey, and the National Park Service.

Included also in these extension services were the intern group of the National Institute of Public Affairs, and the national group of 100 high-school teachers attending the Institute on the position of the United States in World Affairs under the auspices of American University. Included among the college groups visiting the museum were the selected students from State Teachers' College, Minot, N. Dak.

Loan Exhibits and Accessions

Among the notable recent accessions is a large oil painting, 72 by 50 inches, depicting the scene in the State Department at 4 a. m., March 30, 1867, on the occasion of the signing of the Alaska Treaty concerning the

purchase of the Territory. The picture is an excellent copy, by Lynn Faucett and Helen Wessells, of the original which was painted by Leutze, and was placed in the museum by the Division of Territories and Island Possessions. The painting complements the earlier installed museum picture that illustrates the later flag ceremony in Alaska at the time of the actual transfer of the Territory on October 18, 1867, at Sitka, the Russian capital.

Another new feature in the museum is an unusually large animated diorama showing the harbor and environs of the city of Juneau, Alaska. The naturalistic scene and the motion of the shipping and tram cars, and the changing effects of illumination from day to night make this diorama very effective, and of particular and timely interest.

Of great attraction to museum visitors is the recently installed diorama of the central area of Washington, plan of 1939, including the Interior Department Building, loaned by the National Capital Park and Planning Commission. For convenience in comparison the diorama is accompanied by a hand colored map which shows the plan of 1946, covering the same area.

An exhibit of historic interest, loaned by F. E. Dotson, has been added to the helium exhibit. This is a small container filled with a specimen of helium from the United States Navy C-7, first helium-filled airship, Bolling Field, 1920.

Among the temporary loan exhibits is an oil painting, 38 by 30 inches, of the S. S. *North Star*, famous polar vessel, shown in World War II camouflage. This Interior Department ship participated in the United States Antarctic Expedition, 1939-40, United States Antarctic Service, in cooperation with the Division of Territories and Island Possessions, later was commissioned by the United States Navy as a vessel of the United States Coast Guard in 1941, then was returned to the Office of Indian Affairs in 1945, and is now in operation in the Alaskan Service. The picture is on loan from Lt. (jg) M. A. Lee, U. S. C. G. R.

Another special exhibit consists of a collection of 10 books comprising some recent publications relating to Indians, published by the Office of Indian Affairs.

A large sculptured model of the official seal of the Department has been placed at the entrance to the museum.

Orientation Programs

Museum lecture tours have been given throughout the year to all new employees under the orientation program organized by the Division of Personnel and Management. Many comments have been received from individual new employees stressing the value of visualizing their relation

to the work of their Bureaus and the manner in which the individual Bureaus fit into the Department as a whole, as displayed in the museum.

School Classes

Numerous school classes and other organizations have visited the museum during the year. Many requests from school teachers for assistance in preparing study programs on subjects relative to the conservation and other departmental activities have been fulfilled.

Inquiries have been handled daily at the information desk and special services rendered whenever requested. The generous cooperation extended during the year by the offices and bureaus afforded much benefit to the museum.

INDEX

	Page
Board on Geographical Names.....	481
Bonneville Power Administration.....	125
Bonneville Power Administration advance program.....	142
Energy deliveries.....	131
Energy production.....	126
Highlights of fiscal year 1946.....	147
Important special studies.....	145
Local distribution.....	138
Personnel.....	145
Power and regional development.....	135
Revenues.....	125
Transmission system.....	132
Wholesale power rates.....	143
Bureau of Mines.....	155
Foreword.....	155
Summary of activities.....	160
Administration.....	186
Coal and coal product.....	168
Economics and mineral industries.....	180
Explosives research.....	173
Helium.....	173
Mineral development.....	160
Petroleum and natural gas.....	171
Public reports.....	184
Safety and health activities.....	174
Bureau of Reclamation.....	57
Financial operation and control.....	111
Decentralization of accounting.....	117
Operations of Reclamation fund.....	116
Missouri basin construction starts.....	58
Operation and maintenance objectives.....	61
Amendatory and new repayment contracts.....	62
Canal lining program.....	63
Commencement of construction charge payments.....	61
Land ownership survey.....	63
Rehabilitation of operating irrigation projects.....	63
Organization.....	109
Administrative examinations.....	109
Comprehensive manual of instructions.....	109
Decentralization and consolidations.....	110
Establishment of uniform regional staffs.....	110
Personnel recruitment and training.....	118
Employee development plans.....	119
International cooperation.....	120
Personnel changes.....	120
Veterans fill new positions.....	119
Planning horizons.....	76
Program and progress charting.....	110
Field procedures survey.....	111
Power for the west.....	77
Design and construction.....	79
Effect of reconversion.....	80
Research.....	81

	Page
Bureau of Reclamation—Continued	
Reclamation legislation	117
Regional programs	82
Region 1	82
Region 2	86
Region 3	90
Region 4	96
Region 5	99
Region 6	103
Region 7	106
Water conservation and utilization progress	58
Veteran settlement and land development	59
Crop production	60
Major land development programs	60
Public land openings	59
War Relocation Authority centers on Reclamation projects	61
Department safety program	438
Division of Personnel Supervision and Management	434
Division of Power	121
Division of Territories and Island Possessions	407
Alaska	420
Equatorial Islands	425
Hawaii	413
Philippine Islands	425
Puerto Rico	416
Virgin Islands	423
Fish and Wildlife Service	275
Conservation of inland fishery resources	292
Artificial propagation	293
Dams versus fish populations	296
Farm ponds	295
Pollution and the fisheries	297
Conservation of Alaska fishery resources	301
Fur-seal resources	303
Managing the commercial fisheries	301
Conservation of marine fishery resources	297
Great Lakes fisheries	299
North Atlantic fisheries	298
Management of shellfisheries	300
Middle Atlantic fisheries	299
Pacific coast fisheries	300
Cooperative control of predators and rodents	289
Conservation of wildlife resources	282
Effects of DDT on wildlife	282
Federal aid to State projects for the restoration of wildlife	285
Nutritional deficiency in bobwhite quail	283
Patuxent Refuge—a laboratory for conservation	286
Water utilization and wildlife	283
Cooperative wildlife management studies	287
Fur farming and rabbit raising	289
National wildlife refuges	277
Protection of crops and stored foods	291
Protection of livestock and game	290
Status of migratory game birds	276
Wildlife research on public lands	288
Utilization of fishery resources	303
Development of markets	306
Economic research and services	306
Educational services	306
Research on containers for fishery products	305
Research on sources of vitamin A oils	305
Sanitation in fish processing plants	304
Statistics on production and marketing	304

Fish and Wildlife Service—Continued	Page
General Land Office	245
Alaskan Fire Control Service	257
Branch of Field Examination	253
Development of Alaska	247
District land offices	253
Public lands	258
Reorganization	245
Revenues	248
Review of the year's work	248
Surplus real property	258
Surveying the public lands	252
Sustained yield forestry	256
Geological Survey	191
Alaskan Branch	195
Field season of 1945	198
Field season of 1946	199
Future development	197
Mapping activities	199
Past mineral production	196
Conservation Branch	211
Classification of lands	211
Mineral lease supervision	213
Field equipment	218
Funds	219
Geologic Branch	191
Areal geology	192
Basic research	193
Engineering geology	193
Fuels	192
Metals and nonmetallic minerals	191
Military geology	194
Work in other American Republics	195
Library	218
Topographic branch	200
Field surveys	205
General office work	201
Map information office	203
Water Resources Branch	206
Activities carried on for other Federal agencies	208
Interstate and international agreements	210
Cooperation with states and municipalities	208
Operational activities	209
Reports on investigations	211
Work on publications	216
Grazing Service	263
Administrative management	269
Land planning and utilization	268
Range administration	264
Range improvement and maintenance	271
Interior Department Museum	439
Attendance and foreign visitors	439
Collaboration with bureaus	440
Cooperation with other agencies	440
Loan exhibits and accessions	440
Orientation programs	441
School classes	442
Victory exhibit	439
National Park Service	307
Advisory board	334
Concession service rendered under difficulties	310
Dedications mark service's thirtieth anniversary	344
Development planning a complicated task	334
Increased public safety sought	329

	Page
National Park Service—Continued	
Landing fields in parks generally unnecessary	328
New areas added; others in prospect	338
Private lands still a major handicap	320
Problems of winter use	317
Protection presents varied problems	321
Recreational areas need lands and development	342
Service ill-equipped for information work	330
Service is seriously short of personnel	346
Volume of cooperative work grows	336
Natural resources problems	1
Our problems and programs	3
Basic Indian problems	41
Emergency public investment	53
Fish in our future	37
Heat and energy	9
Home on the range	27
Hydroelectric power	15
Land under water	22
Land without people	29
Metal mystery	6
Our parks	33
Problem areas	47
Regionalization	52
Wildlife conservation	40
Office of Indian Affairs	351
Aid to veterans	354
Appropriations consolidated	352
Construction	374
Complexity of the problem	359
Credit for Indians	366
Credit without money	367
Dearth of teachers	359
Delegation of authority	352
Education for veterans	356
Effects of credit	367
Eskimo generosity	354
Fish and game	369
Fish trap sites	380
Fort Garrison Dam	379
4-H Club work	368
Grazing	369
Health for Alaskan native peoples	360
Indian agriculture income	366
Indian arts and crafts	374
Indian Claims Commission	377
Indian cooperation in health measures	361
Indian forests	368
Indian lands for military purposes	365
Indian lands in Missouri Basin	378
Indian liquor legislation	381
Indian response to food crisis	368
Indian schools	357
Indian Service reorganization	352
Indian suffrage	381
Irrigation	371
Land acquisition	364
Memominee swampland	382
Mining	370
Navajos demand schooling	358
Navajo education	357
Nurse classification	363
Oil on Indian lands	369
Old Indian claim paid	378

	Page
Office of Indian Affairs—Continued	
On the farm training	356
Other diseases fought	362
Possessory rights in Alaska	379
Postwar changes	353
Public interest manifested	358
Public food offer	354
Rescued by airplane	373
Reservation roads	373
Reservations in Alaska	380
Schools in Alaska	360
Scope of health service	361
Sioux pony claims	382
Soil and moisture conservation	371
Tribal government	376
Tribal help to veterans	355
Tuberculosis prevention study	362
Use of Indian lands	363
Veterans participate	377
Welfare	375
War and the Aleuts	383
War veterans in the Indian service	382
Office of Land Utilization	235
Accomplishments in coordination	236
Civilian public service camps	243
Forest management	239
Land classification	243
Soil and moisture conservation	237
Water resources committee	242
Office of the Solicitor	393
Oil and Gas Division	231
Genesis and purpose of new division	231
Petroleum Conservation Division and Federal Petroleum Board	233
Violation of the Connally Act	234
Puerto Rico Reconstruction Administration	426
Solid Fuels Administration for War	221
Autumn strikes retard recovery	222
Between the surrenders	221
Coal for liberated nations	227
Compliance problems few	223
Effect of strike on utilities and industry	226
Keeping track of the coal	228
1946 strike revives need for SFAW	224
Prospects for the 1946-47 winter	229
Wartime controls relax	223
Southwestern Power Administration	149
Denison Dam project	151
Grand River Dam project	149
Marketing policies	152
Norfolk Dam project	150
Postwar potentialities	151
Surplus Property Office	429
War Relocation Authority	385
Closing the centers	388
Legal developments	390
Refugee shelter	391
Resettlement	385
Tule Lake	389